# THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. IX.—No. 208.


## THE PARIS ELECTRICAL EXHIBITION.

### THE BRITISH SECTION.

### SIEMENS BROS. & CO., LIMITED.

(*Continued.*)

"MAGNETO EXPLODERS" of various sizes, similar to that described in the number of the Journal for August, 1880, are amongst Messrs. Siemens' exhibits. The largest size will fire ¼ inch of iridio-platinum wire ·0015 in. in diameter, through 70 ohms resistance; the next size will fire the same wire through 50 units. The "large dynamo tension exploders" shown will give a spark $\frac{1}{25}$th inch long; the smallest size will give a spark $\frac{1}{100}$th inch long.

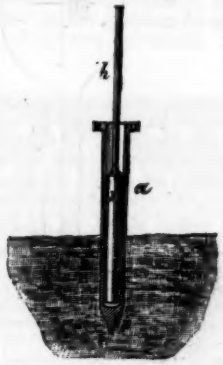



FIG. 8.

FIG. 9.

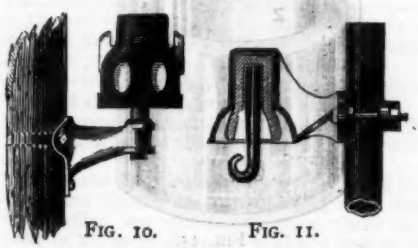


FIG. 10. FIG. 11.

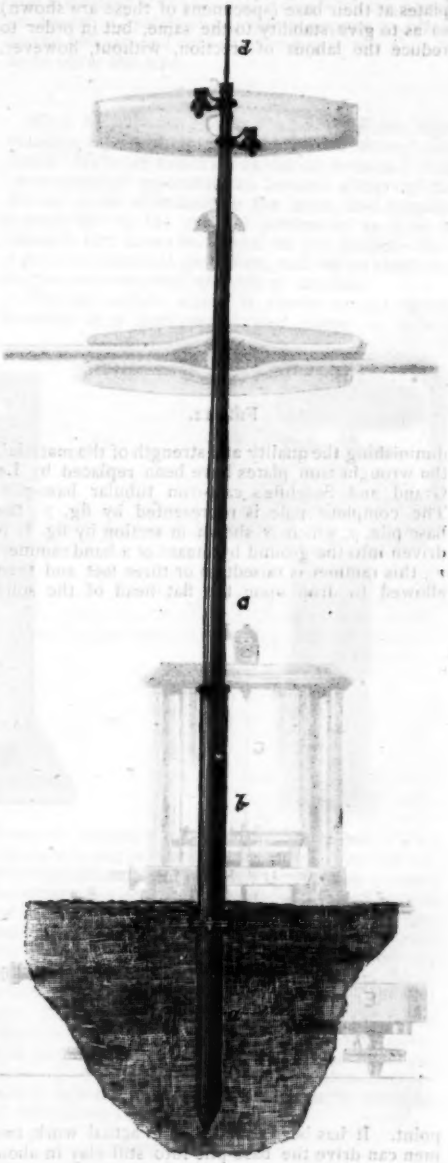



FIG. 7.

Conspicuous amongst the "materials for the construction of land lines," are Messrs. Siemens' well-known "IRON TUBULAR TELEGRAPH POLES." These

poles are constructed with a view to obtain the greatest possible strength and durability, with the least possible weight, and to give each of the pieces composing the pole a convenient form for easy transport. Formerly these poles were made with buckled plates at their base (specimens of these are shown) so as to give stability to the same, but in order to reduce the labour of erection, without, however,

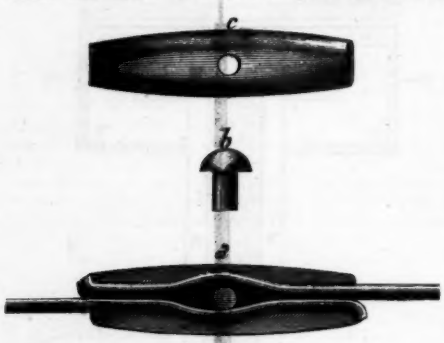



FIG. 12.

diminishing the quality and strength of the material, the wrought-iron plates have been replaced by Le Grand and Sutcliffe's cast-iron tubular base-pile. The complete pole is represented by fig. 7; the base-pile, *a*, which is shown in section by fig. 8, is driven into the ground by means of a hand rammer, *r*; this rammer is raisedtwo or three feet and then allowed to drop upon the flat head of the solid

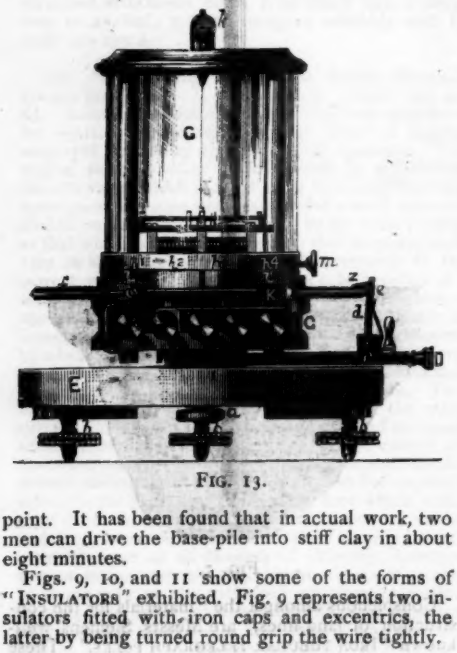



FIG. 13.

point. It has been found that in actual work, two men can drive the base-pile into stiff clay in about eight minutes.

Figs. 9, 10, and 11 show some of the forms of "INSULATORS" exhibited. Fig. 9 represents two insulators fitted with iron caps and excentrics, the latter by being turned round grip the wire tightly.

The "COMPOUND WIRE" exhibited consists of tinned steel wire of the highest quality, around

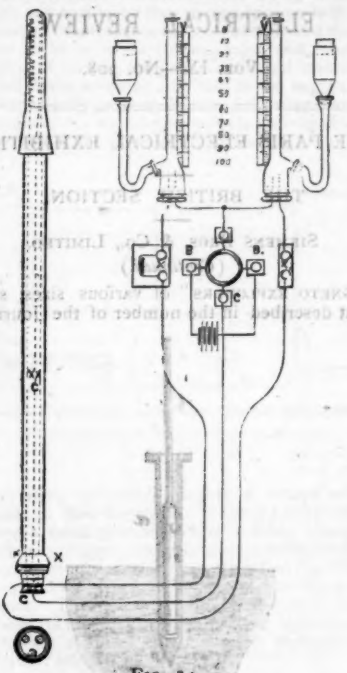



FIG. 14.

which a copper strip is wound helically; both steel and copper, having been drawn through a draw plate, are firmly soldered together, and thus pro-

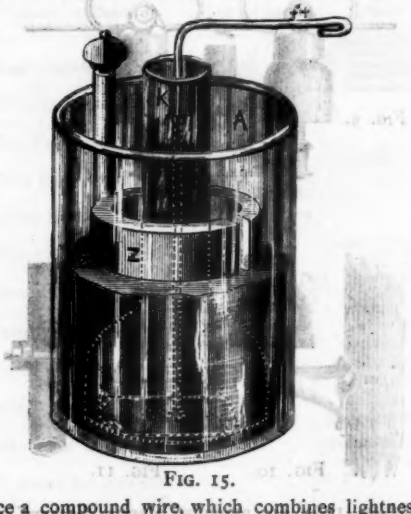
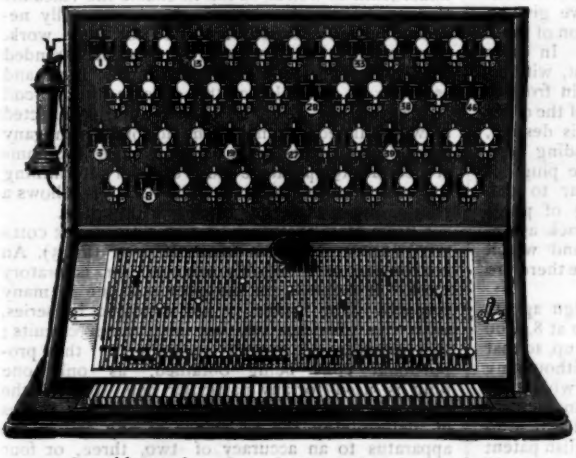



FIG. 15.

duce a compound wire, which combines lightness with strength and high conductivity; this compound wire only weighs one-third of iron wire of

equal electrical capacity. The joint for this wire is shown by fig. 12. It consists of a flat brass tube, *c*, the two ends of the wire are pushed into the tube at each end, and are opened out in the centre by a pointed steel drift; a rivet, *b*, is inserted in the hole thus formed, the ends of the wires are bent round outside the tube, and the entire joint is finished by soldering.

Amongst the "INSTRUMENTS FOR ELECTRICAL TESTING" are sets of resistance coils of the ordinary form, and also portable apparatus, a Thomson's galvanometer, with portable folding lamp and scale stand for same, a Jacob's transparent scale, for reading the mirror indications behind the scale instead of in front, as is usually the case. "Obach's galvanometer," which is shown, has been fully described in the number of the Journal for August 1st, 1879. "SIEMENS' UNIVERSAL GALVANOMETER," which is represented by fig. 13, has been described in the number of the Journal for January 1st, 1874; this instrument is a very useful



one, and enables resistances, electromotive forces, and current strengths, to be measured with a considerable degree of accuracy. The "ELECTRICAL PYROMETER," shown by fig. 14 (*see also* TELEGRAPHIC JOURNAL, October 15th, 1873) is for the purpose of measuring temperatures by ascertaining the resistance of a wire at the unknown temperature, the resistance at a known temperature being given; the resistances are measured by a differential voltameter.

For electric light measurements, resistances of carbon and also of hoop iron are shown.

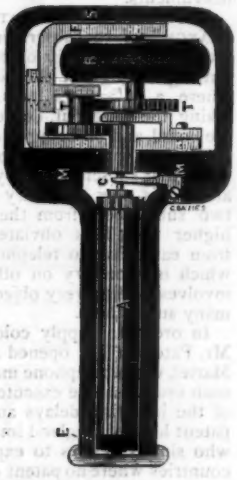
The telegraph instruments exhibited are of the ordinary patterns, and do not call for any particular remark.

Amongst the "BATTERIES," are specimens of the Siemens and Halske constant cell (fig. 15). This battery, which was introduced some years ago, consists of an outer glass jar, A, at the bottom of which rests a porous bell-shaped cell, with a glass tube, K, cemented into the cylindrical top of the cell; the positive pole is a piece of bent sheet copper, to which a copper wire, *f*, is rivetted; paper pulp, *e*, saturated with a strong solution of salt, is firmly pressed down over the porous cell and around the glass tube to about half the height of the outer jar, this paper pulp forms the diaphragm, and is covered at the top with a disc of blotting paper or flannel. Crystals of sulphate of copper are placed in the bell jar, and acidulated water in the jar, A, so as to cover the zinc.

J. A. RUDGE.

Mr. J. A. Rudge, of 1, New Bond Street Place, Bath, exhibits an "ELECTRO-MAGNETIC AIR PUMP," and also a "MEDICAL ELECTRIC BRUSH OR RUBBER." This latter piece of apparatus can be used either by the patient or the attendant on the latter, and supplies a want felt by the medical profession, as it is so portable that it can be carried in the pocket. It is a genuine electrical generator, and can be regulated to give any required strength of current.

The instrument, which is shown by the figure, consists of a steel magnetised frame, S, with a



Siemens' armature, A, between its poles. This armature is put in motion by the brush or rubber, which is connected to the same by a train of wheels; the latter are electrically connected to one end of the wire on the armature by a spring; the other end of the wire is connected to the frame. Terminals are fixed to the apparatus, to which wires can be attached leading to any part of the body required to be operated on. The brass frame, F, is insulated from the magnet by insulating material, M. The rubber or brush, R, when rubbed on the skin generates the current by causing the armature to revolve. The whole of the mechanism of the apparatus is inclosed in a mahogany case, so that nothing but the rubber is seen.

EDWARD PATERSON.

The exhibits of Mr. E. Paterson, of St. Paul's Works, 76, Little Britain, Aldersgate Street, comprise "Electric signalling instruments," "Telephones and telephonic apparatus" of various descriptions, and the new "Electric light measuring apparatus" of Professors Ayrton and Perry.

In "Electric signalling instruments" for domestic use, for hotels, ships, mines, &c., the exhibitor claims no particular features of novelty, unless good sound workmanship and reasonable prices may be considered such.

The telephone exhibits comprise ebonite telephones, with single and double poles, and Gower-Bell loud-speaking telephones, of which Edward Paterson has been the sole maker up to the present, with one or two unimportant exceptions. Probably one of the most successful installations of telephones is that of three Gower-Bell loud-speaking telephones, supplied to M. Houzean, of the Royal Observatory, Brussels. The instruments are used to connect the observatory with two of the fourteen meteorological stations, distant 80 and 110 miles, respectively. These are found to be perfectly satisfactory and to answer admirably.

The "carbon transmitters, with double pole ebonite telephones," which are shown, form a very good substitute for the Gower-Bell loud-speaking instruments.

The "CENTRAL APPARATUS FOR A TELEPHONE EXCHANGE" of 50 subscribers, of which we give an illustration, has for its object the promotion of rapid putting through at the central station. In cases where a subscriber calls, the attendant, without taking the plug out, depresses the key in front of the board, and on being told the number of the other subscriber with whom communication is desired, rings that subscriber up by his corresponding key; all that is now necessary is to shift the plugs of two subscribers from the bottom E bar to one higher up. This obviates the shifting of plugs from earth bar to telephone bar, and back again, which is necessary on other systems, and which involves a delay very objectionable where there are many subscribers.

In order to supply colonial and foreign agents Mr. Paterson has opened a branch house at 8, Rue Martel, where telephone material is made up, so that such orders can be executed promptly without any of the irritating delays and restrictions which the patent laws of England impose on the manufacturer who simply desires to export a patented article to countries where no patent exists, the English patent laws differing in this respect from those of nearly all other countries to the prejudice of the manufacturer, and without any benefit accruing to the patentee.

The exhibits in "Electric light testing apparatus" comprise Professor Ayrton and Perry's "Portable dead beat galvanometer" (*see* TELEGRAPHIC JOURNAL, June 1st, 1881), also their "Dynamometer," their "Dispersion photometer," and their "Dynamometer coupling."

## JOSEPH BOURNE AND SON.

We have to call attention to an error in our description of the exhibit of the above firm, which we gave on page 353 of the last number of the Journal; the material of which the insulators, &c., are constructed was stated to be "*porcelain*"; it should have been "*stoneware*." That Messrs. Bourne should have succeeded in producing such fine specimens of the latter material is a highly creditable fact.

## ELLIOTT BROS.

The exhibit of Messrs. Elliott Bros., of 101, St. Martin's Lane, Charing Cross, is conspicuous for the excellence of workmanship and finish for which this firm of electrical instrument makers is so well known. The most important of the instruments shown are the following:—

"SLATE RESISTANCE COILS" (fig. 1). These are specially intended for powerful currents. The wires are wound round a number of slates in the box, and the box is perforated that air may have free access to the wires. The convolutions of the bare German silver or iron wires are kept separate from each other by being wound on the serrated edges of the slates.

"FOUR-DIAL PLATINUM SILVER RESISTANCE COILS WITH THERMO-COILS" (fig. 2). A great advantage in these sets is, that in all tests there are never more than four plugs (one in each dial) used at a time. Each set or dial can be used quite independent of the others, and, between each set, channels are made underneath as well as on top to enable the vulcanite slab to be readily cleaned, this is especially necessary when the coils are used for cable work. The bridge is connected by a stout stranded copper wire. Inside the resistance box, and as close as possible to the coils, a thermo-coil is inserted, this coil has its extremities connected to two insulated terminals at the side of the mahogany tray. The thermo-coil has a resistance of 100 ohms at a certain temperature and is used for determining the temperature inside the box. Fig. 2A shows a plan of one of these sets of coils with 5 dials.

"FOUR DIAL PLATINUM SILVER RESISTANCE COILS WITH BRIDGE WIRE AND COMMUNICATOR" (fig. 3). An instrument very suitably arranged for laboratory work. It differs from the previous one in many respects. The bridge is not arranged in series, as in the previous set, but in parallel circuits; this permits of greater accuracy in the proportional coils being obtained, as only one plug is used for any particular coil. Besides the coils a bridge wire is added, this gives a means of determining the resistance of any coil in the apparatus to an accuracy of two, three, or four decimal places, and consequently enables an unknown resistance to be determined to a similar degree of accuracy. A commutator is added to enable the mean readings of the bridge wire to be obtained with facility. On the right hand of the bridge, one additional block and plug may be observed, this serves to exclude the bridge wire, when the resistances in the bridge are not equal, but have a ratio of 1 to 10, 1 to 100, &c. The unknown resistance can be inserted on either side of the apparatus. This is often of great convenience

"PORTABLE UNIFILAR MAGNETOMETER (figs. 4 and 5). Kew pattern, for determining the horizontal intensity of the terrestrial magnetic force and also the declination.

This instrument is mounted like a theodolite and consists of two parts, one serving for the deflection and the other for the vibration and declination. In the present improved form of the instrument two magnets and one telescope only are required for all determinations, whereas the older instruments have three magnets and two telescopes, making the instruments and the working with them

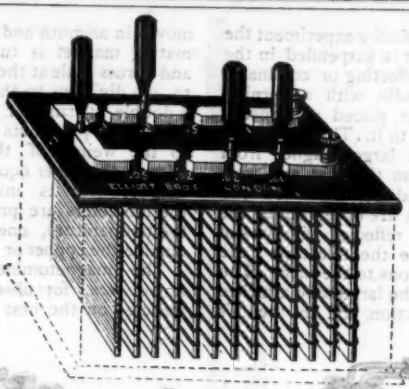


FIG. 1.

FIG 2.

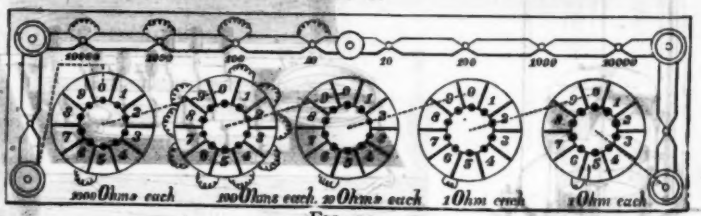



FIG. 2A.

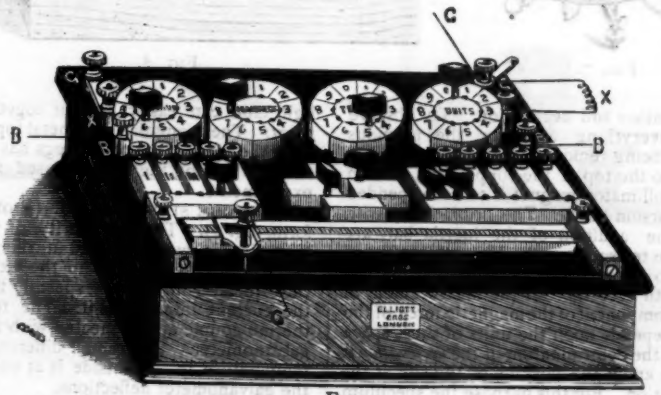



FIG. 3.

more complicated. For the *deflection* experiment the small magnet with its mirror is suspended in the copper box, and the large deflecting or collimator magnet is placed in the cradle, with a vernier, which slides on a divided bar, placed underneath the copper box at right angles to it. The deflections which are produced by the large magnet from various definite distances from the east and west side (either when the marked or unmarked end faces the suspended magnet) are observed by the telescope which receives the reflected divisions of the ivory scale placed above the telescope; the scale is gradiated to 100 divisions to the inch. The telescope rests in V's inside the large tube attached to the copper box for deflection, and in the V's outside for vibration and declination. To observe *the vibration* everything used for the previous determination, being removed, the wooden box has to be secured to the top of the copper box, and in the latter the collimator magnet is to be suspended by its own torsion-head. The vibrations, with and without the addition of the inertia bar, are observed by the telescope in the V's on top of large tube. The two observations of deflection and vibrations are both necessary for the measurement of the horizontal component of the magnetic force of the earth, as this depends upon the units of time, space and mass. For the determination of the *declination* it is necessary to know the position of the sun at the time of observation. For this purpose the speculum transit mirror above the counterpoise (which moves in azimuth and altitude), is used. The collimating magnet is tubular with a lens at one end and a cross scale at the other; this scale is graduated to 400 divisions to the inch. The magnet rests in a double stirrup for the reception of the inertia bar. Two plummets are provided, one being equal to the weight of the collimating magnet and stirrup, the other equal to the weight of the small magnet with its mirror and mountings. Two thermometers are provided for the observation of the temperature, one placed inside and the other outside the copper or mahogany box.

The magnetometer is usually placed on a *tripod stand* for observation. This stand is constructed on the best principles, it is very firm and light and can easily be put together and taken apart. The triangular gun-metal top, packs separate from the legs. One of the legs has a metallic case or tube holding the long bar used in the deflection experiments.

FIG. 6.

FIG. 9.

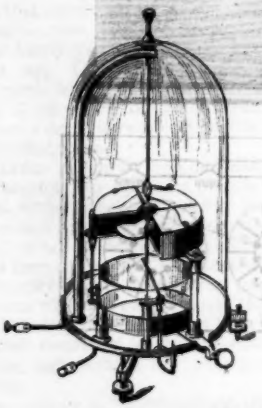


FIG. 7.

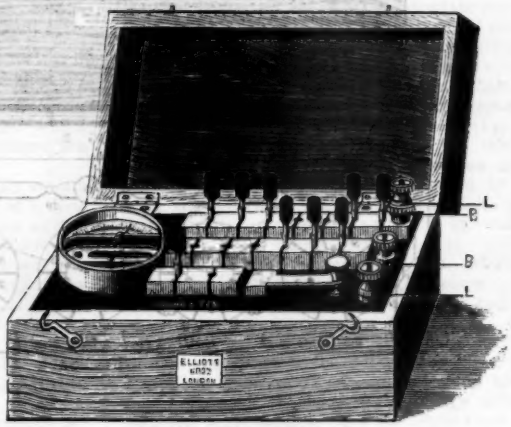



FIG. 8.

"TEN OHM STANDARD COIL" (Professor Chrystal's form, fig. 6). The peculiarity of this coil is that the wire is wound round a thermo-couple in a narrow flat tube, to take up the external temperature quickly and to lose speedily the temperature the current imparts to it. The terminals of the thermo-couple are connected with a low resistance galvanometer. Any small difference between the temperature in or outside is at once indicated by the galvanometer deflections.

The "SETS OF PLATINUM SILVER COILS," with and

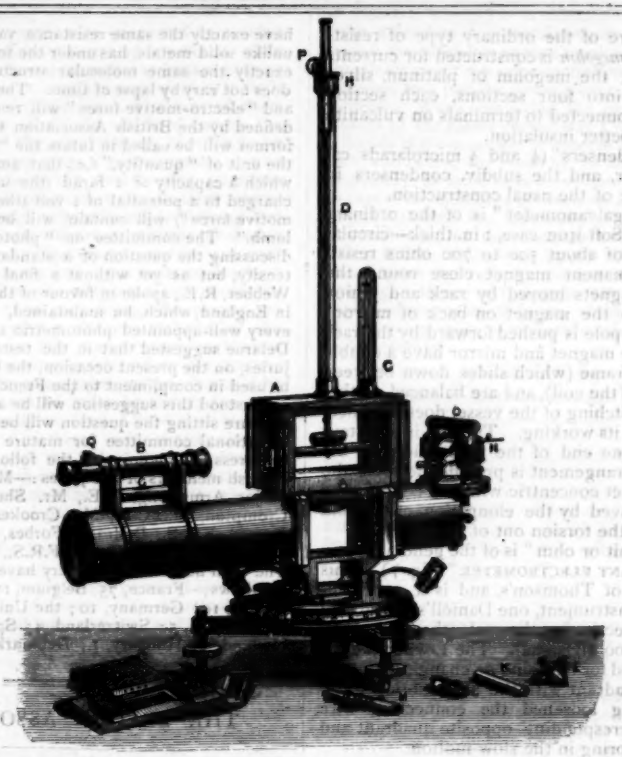



FIG. 4.

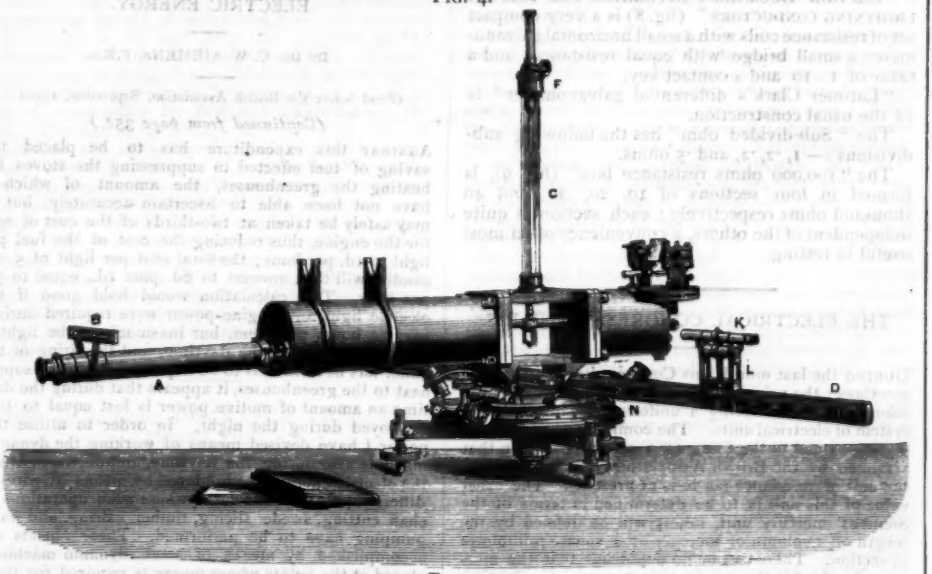



FIG. 5.

without bridge are of the ordinary type of resistance coils. The *megohm* is constructed for currents of high tension; the megohm of platinum silver wire is divided into four sections, each section having its ends connected to terminals on vulcanite pillars to insure better insulation.

All the "Condensers" ($\frac{1}{3}$ and $\frac{1}{4}$ microfarads capacity in circular, and the subdiv. condensers in oblong boxes) are of the usual construction.

The "Marine galvanometer" is of the ordinary description, viz., Soft iron case, 1 in. thick—circular coil of fine wire of about 500 to 700 ohms resistance—fixed permanent magnet close round the coil, and two magnets moved by rack and pinion perpendicular to the magnet on back of mirror; either the N or S pole is pushed forward by the rack and pinion. The magnet and mirror have a double suspension in a frame (which slides down between the two halves of the coil), and are balanced so that the rolling and pitching of the vessel does not affect or interfere with its working. The silk is kept taut by a spring at one end of the suspension, at the other a simple arrangement is provided to bring the mirror and magnet concentric with the coil, if they should have moved by the elongation of the silk fibre, and to get the torsion out of the silk fibre.

The "B. A. unit or ohm" is of the general type.

The "QUADRANT ELECTROMETER" (fig. 7). This is a modification of Thomson's, and is a very delicate and useful instrument, one Daniell's cell giving 100 divisions deflection on the scale (the Thomson's will give about 300 divisions). The Leyden jar can be easily removed for charging or changing the acid by sliding the quadrant with the slow motion quite out, after having loosened the connecting wire between the corresponding opposite quadrant and taking out the spring in the slow motion.

"CAPTAIN BUCKNILL'S APPARATUS FOR TESTING LIGHTNING CONDUCTORS" (fig. 8) is a very compact set of resistance coils with a small horizontal galvanometer, a small bridge with equal resistances and a ratio of 1 : 10 and a contact key.

"Latimer Clark's differential galvanometer" is of the usual construction.

The "Sub-divided ohm" has the following subdivisions :—·1, ·2, ·2, and ·5 ohms.

The "100,000 ohms resistance box" (fig. 9), is formed in four sections of 10, 20, 30, and 40 thousand ohms respectively; each section is quite independent of the others, a convenience often most useful in testing.

## THE ELECTRICAL CONGRESS AT PARIS.

DURING the last month this Congress has held several meetings; the principal subject discussed has been the advisability of adopting a uniform and international system of electrical units. The committee have agreed to recommend to the Congress a system based on that arranged by the British Association, making the ohm the unit of resistance (as it is at present). The exact value of this unit is to be determined in terms of the Siemens' mercury unit, *i.e.*, it will be defined by the length of a column of mercury of a square millimetre in section. There can be no doubt but that the mercury standard is the most satisfactory one to adopt, as any number of standards of pure mercury at any particular temperature, and of definite dimensions, will have exactly the same resistance value, since mercury, unlike solid metals, has under the foregoing conditions exactly the same molecular structure, and the latter does not vary by lapse of time. The units of "current" and "electro-motive force" will remain as at present defined by the British Association Committee, but the former will be called in future the "ampère," whilst to the unit of "quantity," *i.e.*, that amount of electricity which a capacity of 1 farad (the unit of "capacity") charged to a potential of 1 volt (the unit of "electro-motive force") will contain, will be called the "coulomb." The committee on "photometry" have been discussing the question of a standard of luminous intensity, but as yet without a final decision. Colonel Webber, R.E., spoke in favour of the candle employed in England, which, he maintained, burned steadily in every well-appointed photometric room. Mr. Warren Delarue suggested that in the tests and trials of the juries, on the present occasion, the Carcel lamp should be used in compliment to the French people; and it is understood this suggestion will be adopted, and that at a future sitting the question will be referred to an international committee for mature deliberation. The Congress have nominated the following gentlemen as English members of the juries :—Mr. Warren Delarue, Major Armstrong, R.E., Mr. Shelford Bidwell, Mr. Crompton, M.S.C.E., Mr. Crookes, F.R.S., Professor Everett, F.R.S., Professor Forbes, Mr. J. F. Moulton, F.R.S., Mr. W. H. Preece, F.R.S., and Mr. A. Stroh. The total numbers of the jury have been finally settled as follows :—France, 75; Belgium, 11; Great Britain and Ireland, 10; Germany, 10; the United States, 7; Italy, 10; Sweden, 5; Switzerland, 4; Spain, 3; Norway, 3; Holland, 3; Hungary, 1; Denmark, 1; and Japan, 1.

## THE BRITISH ASSOCIATION.

### ELECTRIC ENERGY.

By DR. C. W. SIEMENS, F.R.S.

(Read before the British Association, September, 1881.)

*(Continued from page 352.)*

AGAINST this expenditure has to be placed the saving of fuel effected in suppressing the stoves for heating the greenhouses, the amount of which I have not been able to ascertain accurately, but it may safely be taken at two-thirds of the cost of coal for the engine, thus reducing the cost of the fuel per light to 1d. per hour; the total cost per light of 5,000 candles will thus amount to 6d. plus 1d., equal to 7d. per hour. This calculation would hold good if the electric light and engine-power were required during, say, 12 hours per diem, but inasmuch as the light is not required during the daytime, and the firing of the boiler has nevertheless to be kept up in order to supply heat to the greenhouses, it appears that during the daytime an amount of motive power is lost equal to that employed during the night. In order to utilise this power I have devised means of working the dynamo-machine also during the daytime, and of transmitting the electric energy thus produced by means of wires to different points of the farm where such operations as chaff cutting, swede slicing, timber sawing, and water pumping have to be performed. These objects are accomplished by means of small dynamo machines, placed at the points where power is required for these various purposes, and which are in metallic connection with the current-generating dynamo-machine near the

engine. The connecting wires employed consist each of a naked strand of copper wire, supported on wooden poles, or on trees, without the use of insulators, while the return circuit is effected through the park railing or wire fencing of the place, which is connected with both transmitting and working machines, by means of short pieces of connecting wire. In order to insure the metallic continuity of the wire fencing, care has to be taken wherever there are gates to solder a piece of wire buried below the gate to the wire fencing on either side. As regards pumping the water, a three horse-power steam engine was originally used, working two force-pumps, of 3¾-inch diameter, making 36 double strokes per minute. The same pumps are still employed, being now worked by a dynamo-machine weighing 4 cwt. When the cisterns at the house, the gardens, and the farm require filling, the pumps are started by simply turning the commutator at the engine station, and in like manner the mechanical operations of the farm already referred to are accomplished by one and the same prime mover. It would be difficult in this instance to state accurately the percentage of power actually received at the distant station, but in trying the same machines under similar circumstances of resistance with the aid of dynamometers as much as 60 per cent. has been realised. In conclusion, I have pleasure to state that the working of the electric light and transmission of power for the various operations just named, are entirely under the charge of my head gardener, Mr. Buchanan, assisted by the ordinary staff of under gardeners and field labourers, who probably never before heard of the power of electricity. Electric transmission of power may eventually be applied also to threshing, reaping, and ploughing. These objects are at the present time accomplished to a large extent by means of portable steam engines, a class of engine which has attained a high degree of perfection, but the electro-motor presents the great advantage of lightness, its weight per horse-power being only 2 cwt., while the weight of a portable engine, with its boiler filled with water, may be taken at 15 cwt. per horse power. Moreover the portable engine requires a continuous supply of water and fuel, and involves skilled labour in the field, while the electrical engine receives it food through the wire (or a light rail upon which it may be made to move about) from the central station, where power can be produced at a cheaper rate of expenditure for fuel and labour than in the field. The use of secondary batteries may also be resorted to with advantage to store electrical energy when it cannot be utilised. In thus accomplishing the work of a farm from a central power station, considerable savings of plant and labour may be effected; the engine power will be chiefly required for day work, and its night work, for the purposes of electro-horticulture, will be a secondary utilisation of the establishment, involving little extra expense. At the same time the means are provided of lighting the hall and shrubberies in the most perfect manner, and of producing effects in landscape gardening that are strikingly beautiful.

## THE ELECTRIC DISCHARGE THROUGH COLZA OIL.

By A. MACFARLANE, M.A., D.Sc., F.R.S.E.
(Read before the British Association, Sept., 1881.)

THE electrical properties of colza oil which I have examined, are its dielectric strength, and some phenomena which accompany the passage of the spark. By the dielectric strength of a substance I mean the ratio of the difference of potential required to pass a spark through the substance to that required to pass a spark through air under the same conditions. The electrodes used were two parallel brass plates, each 4 inches in diameter. When comparing the gases, the standard distance of the plates chosen was 5 mm. In the case of liquids it is convenient to observe from a shorter distance, and reduce the result by the law which previous experiments of mine have established, namely, that in the case of the discharge between parallel plates through a liquid dielectric the difference of potential required is proportional to the distance between the plates. (Trans. R.S.E., vol. xxix. p. 563.) One set of observations gave the ratio for colza oil to be 2·7; another gave 2·5. Hence 2·6 may be taken. The specific gravity of the colza oil is ·91. I have now obtained the following table of dielectric strengths for liquids (air being unity).

| Substance. | Dielectric Strength. | Reciprocal of Relative Striking Distance. |
|---|---|---|
| Paraffin Oil..... | 3·7 | ... |
| Oil of Turpentine... | 4·0 | 16 |
| Paraffin (liquefied). | 2·4 | ... |
| Olive Oil..... | 3·5 | ... |
| Colza Oil..... | 2·6 | ... |
| Ether..... | ... | 7·8 |
| Spirit of Wine..... | ... | 8·0 |
| Absolute Alcohol.. | ... | 12·0 |
| Water..... | ... | 11·6 |

The values given in the third column were published by Masson. He found by the method of Faraday the relative striking distance for the substance with respect to that for air, and the entry gives the reciprocal of that ratio. He used balls for electrodes; in such a case the difference of potential is proportional, not to the distance between the balls, but to the square root of that distance. In the case of oil of turpentine, which has been examined by both methods, this relation is verified exactly.

The passage of the spark was accompanied by the formation of gas-bubbles, but there was no deposition of solid particles. As the four-inch plates were placed horizontally in the oil, a bubble produced by a discharge was prevented from escaping by the upper plate. When the upper plate is again electrified, such a bubble behaves in the following manner: If it is large enough, it will extend itself between the plates; but if it is smaller it takes the form of an acorn with a flat base, the base resting on one or other of the plates. When the upper plate is charged positively, the bubble is repelled so as to place its base on the lower plate; when the electricity is changed to negative the bubble remains with its base on the upper plate. A reversal of the order of the charging did not change the effect. After a few electrifications a sufficient number of solid particles collects to form a chain; and thus interferes with the phenomenon, the bubbles then being lengthened out in a remarkable manner, but never repelled to the lower plate.

When the upper plate was charged negatively, gas bubbles appeared to me to rise from the lower plate, as if they had been formed there. To test this point further I took some sparks between two smaller discs placed vertically in the oil. The gas-bubbles were observed to rise up at the negative surface, as if they had been formed at the positive surface, and had been repelled or carried straight across and then rose up at the negative surface. When the spark was taken between two points bent at right angles to two rods dipping into the oil, the bubbles were observed to shoot

out in the direction from the positively charged point, and to circulate round the earth-rod before rising to the surface. These phenomena indicate that the bubble is positively electrified.

## ON THE APPLICATION OF ELECTRICITY TO THE LOCALISATION OF A BULLET IN A WOUND.

By W. H. PREECE, F.R.S.

(Read before the British Association, Sept. 1881.)

ANY application of electricity that can aid the practice of surgery and lead to the total suppression of pain, must fulfil one of the highest functions of the art of applying the great forces of nature to the wants of man.

I purpose to show how an electric current can be made an invisible and immaterial probe, localising the position of a bullet without touching the human body or inflicting the slightest sensation of pain. Electricity has already been used for probing purposes, but only to detect, by the ringing of a bell, the fact that a metallic mass has been touched by the point of the instrument. The operation was performed, with all its pain to the wounded sufferer, and electricity was employed only as an agent more sensitive than the touch.

The conception of using electricity alone as the tool itself for this purpose occurred to Professor Graham Bell in Washington. He telegraphed to me on the subject to consult with Professor Hughes as to the use of his induction balance for the purpose. Professor Hughes threw his whole heart into the matter. Full directions were sent out to Professor Bell, who was independently experimenting on the subject with Mr. Tainter. Experiments were made by him upon President Garfield, and there is every reason to believe that the position of the bullet has been unmistakeably localised.

(Mr. Preece then proceeded to describe the principle of the induction balance generally, and also of the apparatus devised for the special purpose of localising the position of a bullet in a wound. The description was similar to that given on page 317 of the number of the Journal for August 15th.)

The apparatus admits of much variation in form, and I have no doubt that Professor Hughes will shortly devise a practical form which can be placed in the hands of any surgeon.

Professor Bell and Mr. Sumner Tainter have worked assiduously at the matter, and have considerably modified the instrument and increased its sensitiveness. They have extended its range to five inches. Professor Bell's report to the surgeons in attendance on President Garfield is interesting:—"I beg to submit for your information a brief statement of the results obtained here with the new form of induction balance, in the experiments made this morning for the purpose of locating the bullet in the person of the president. The instrument was tested for sensitiveness several times during the course of the experiments, and it was found to respond well to the presentation of a flattened bullet at a distance of about four inches from the coils. When the exploring coils were passed over that part of the abdomen where a sonorous spot was observed in the experiments made on July 26th, a feeble tone was perceived, but the effect was audible a considerable distance around this spot. The sounds were too feeble to be entirely satisfactory, as I had reason to expect from the extreme sensitiveness of the instrument, a much more marked effect. In order to ascertain whether similar sounds might not be obtained in other localities, I explored the whole right side and back below the point of entrance of the bullet; but no part gave indications of the presence of metal, except an area of about two inches in diameter, containing within it the spot previously found to be sonorous. The experiments were repeated by Mr. Tainter, who obtained exactly corresponding results. We are, therefore, justified in concluding that the ball is located within the above-named area. In our preliminary experiments we found that a bullet, like the one in question, which in its normal shape produced no audible effect beyond a distance of 2½ inches, while the same bullet flattened and presented with its face parallel to the plane of the coils, gave indications up to a distance of nearly five inches. The same flattened bullet, held with its face perpendicular to the plane of the coils, produced no sound beyond a distance of one inch. These facts show, that in ignorance of the actual shape and mode of presentation of the bullet to the exploring instrument, the depth at which the bullet lies beneath the surface cannot be determined from our experiments."

This shows that much remains to be done to render the instrument practical and useful; but, nevertheless, we have clear evidence of a new application of electricity, which will be beneficial and valuable.

## SOME OF BELL AND TAINTER'S RECENT RESEARCHES, AND THEIR CONSEQUENCES.

By WM. LANT CARPENTER, B.A., B.Sc., F.C.S.

(Read before the British Association, Sept., 1881.)

THE author described in general terms the experiments of Messrs. Bell and Tainter, intended to prove that sonorousness was a universal property of matter, when submitted to the influence of an intermittent beam of light, and he described particularly their instrument for determining and comparing the limit of sonorousness of any particular substance, and of any particular molecular condition and colour of that substance (*e.g.*, porous bodies were more sonorous than dense, dark coloured than light, &c.) It had occurred to the author that if, instead of using two receivers with different substances under the same intermittent beam, the same substance were used and two different beams employed, the comparative intensities of these beams might be arrived at by the limit of sonorousness of the receiver under the influence of any particular intermittent beam. In fact, that a photometer might thus be constructed, in which light intensities (or rather radiant energies) might be compared by listening to the sounds produced when intermittent beams from the lights fell upon a standard sensitive receiver. Rough experiments, in which Dr. S. P. Thompson had assisted the author, gave ground for the correctness of this view, but the instrument would not be at all a delicate one.

## A CONTRIBUTION TO THE HISTORY OF SECONDARY BATTERIES.

By Dr. C. W. SIEMENS, F.R.S.

(Read before the British Association, Sept., 1881.)

THE surprising effects realised by Faure give particular interest at the present time to the general subject of secondary batteries and, it may not be uninteresting to

give an account of some early attempts in this direction with which I have been connected.

The earliest and, as regards its principle of action, the most perfect and admirable form of secondary battery is, he ventured to think, that proposed by Sir William Grove as early as 1841. It consisted, as is well known, of two test tubes with a strip of platinised platinum suspended in each from an electrode passing through the tube, the two tubes dipping with their open ends into a trough filled with acidulated water.

In passing a galvanic current through such a pair, hydrogen is developed in the one tube and oxygen in the other in the well-known proportions, and if the battery be disconnected, and the electrodes be connected by means of a wire, with a galvanometer of high resistance, it will be found that a continuous current is produced, exceeding a Daniell element in electro-motive force, which current continues to flow until the whole of the gases accumulated previously in the tubes by means of the galvanic current have recombined. The current so produced necessarily equals that by which the decomposition was effected, barring only losses by resistance, which, in the case of Grove's gas battery, admit of the utmost reduction. The drawback to any practical use that could be made of the Grove gas battery is that the active surface of triple contact between the metal, the acidulated water, and the gas is exceedingly small, and consequently that the amount of current to be got from such a battery in a given time is also too small for practical use.

In the year 1852 the problem was put to me whether by some modification of the Grove gas battery, it would not be possible to obtain larger effects, and, applying myself to the question, I undertook a series of experiments, the results of which were embodied in a report, which was deemed satisfactory at the time, but has never been published. Now, however, these results appear to reassume some practical value. Starting with the Grove battery, I endeavoured to obtain a form of electrode presenting a large surface of triple contact. Platinum appeared ill-suited for the attainment of such an object, and I consequently directed my attention to carbon, such as is deposited in gas retorts, as being a cheaper material, and one that, owing to its porosity and roughness of surface, seemed well calculated for the development of surface action. Two pieces of such carbon inserted into inverted glass tubes similarly to the strips of platinum already referred to, gave rise to currents of larger quantitive effect, although somewhat inferior in intensity to those produced by the platinum strips. The intensity, however, was greatly increased by subjecting the carbons previous to use to a process of platinisation, or galvanic deposition of pulverulent platinum on their surfaces. The next step was to put carbon into the shape of tubes open at one end and closed at the other. A number of these tubes were inserted in a square box of gutta-percha in rows traversing the box alternately in one direction and the other, the box being ultimately placed edge-ways and connected with two chambers covering respectively the open ends of the two series of tubes. By filling these two chambers, the one with oxygen, the other with hydrogen gas, and filling the square box containing the tubes with acidulated water, I succeeded in converting the entire carbon surfaces into surfaces of triple contact of carbon, acidulated water, and oxygen and hydrogen gas respectively, owing to the porosity of the material of the tubes; and it was only necessary to connect the upper closed and protruding ends of the tubes by means of wire in order to constitute the arrangement of a gas battery of considerable power. Nevertheless, the current was insufficient for my purpose, though care had been taken to platinise the tubes.

With a view of increasing the potential of the currents, I directed my attention to the peroxides of metals, and soon found that peroxide of lead was the one giving the greatest promise of results. The tubes were plunged, after drying, into a strong solution of acetate of lead, then dried and heated to a dull redness, and again immersed in the lead solution. After repeating this process several times, they were placed in position, and a strong battery current was passed through them, by which the lead was converted into peroxide. The increase of current resulting from this mode of treatment was so remarkable that I was able to effect the decomposition of water by means of one such carbon-lead gas battery by connecting it to a voltameter. No reliable methods of ascertaining the potential of the current were available at that time, but, judging by the results, the power of two volts must have been reached.

It was, however, found difficult to obtain a supply of carbon tubes of the right degree of porosity, and I therefore fell back on a simpler form of battery, consisting of two bars or rods of dense carbon, upon each of which a long series of thin laminæ of porous carbon, pierced laterally by holes to admit the carbon rod, were strung, a certain distance between the laminæ being insured by washers of the same material. Two such bars of carbon with their laminæ were placed side by side in a cylinder of gutta-percha with a dividing diaphragm of porous clay, and constituted, when impregnated with peroxide of lead, a powerful galvanic cell. The power of the cell depended more, however, on the power and time of application of the exciting current than upon the gases admitted into the cylinder, showing that it was chiefly due to the presence of the peroxide of lead formed by the exciting current.

These exciting currents produced by a Grove nitric-acid battery were, however, too expensive to render the secondary battery available for practical purposes, whereas by the use of dynamo currents, results might have been obtained comparable to those obtained by means of the Faure battery. By the substitution of porous carbon for sheet lead in the secondary battery of the present day, the intervening layers of felt would be dispensed with, and a large amount of active surface be aggregated in a comparatively small space.

## THE PROPER PROPORTIONS OF RESISTANCE IN THE WORKING COILS, THE ELECTRO-MAGNETS, AND THE EXTERNAL CURRENTS OF DYNAMOS.

By Sir WILLIAM THOMSON, F.R.S.

(Read before the British Association, Sept., 1881.)

IF $R$ be the resistance of the electro-magnet, $R_1$ the resistance of the working coil, then the question is, how ought $R$ and $R_1$ to be proportioned to make the ratio of waste to work a minimum. For the ordinary dynamo, the result of the investigation shows that $R_1$ should be somewhat greater than

$$\frac{R + R_1}{2}$$

the exact value depending upon the magnetic susceptibility of the iron in the machine, the forms, magnitudes, and relative positions of the wire on the machine, &c., &c., quantities which cannot be determined theoretically. In the shunt dynamo, if $E$ be the resistance connecting the terminals of the machine, then it is best to have approximately $E = \sqrt{RR_1}$.

## ON SOME USES OF FAURE'S ACCUMULATOR IN CONNECTION WITH LIGHTING BY ELECTRICITY.

By Sir W. THOMSON, F.R.S.

(Read before the British Association, Sept., 1881.)

THE largest use of Faure's accumulator in electric lighting was to allow steam or other motive power and dynamos to work economically all day, or throughout the twenty-four hours where the circumstances were such as to render this economical, and storing up energy to be drawn upon when the light was required. There was also a very valuable use of the accumulator in its application as an adjunct to the dynamo, regulating the light-giving current and storing up an irregular surplus in such a manner that stoppage of the engine would not stop the light, but only reduce it slightly, and that there would always be a good residue of two or three hours' supply of full lighting power, or a supply for eight or ten hours of light for a diminished number of lamps. He showed an automatic instrument which he had designed and constructed to break and make the circuit between the Faure battery and the dynamo, so as automatically to fulfil the conditions described in the paper. This instrument also guarded the coils of the dynamo from damage, and the accumulator battery from loss, by the current flowing back, if at any moment the electromotive force of the dynamo flagged so much as to be overpowered by the battery.

## ON THE ECONOMY OF METAL IN CONDUCTORS OF ELECTRICITY.

By Sir W. THOMSON, F.R.S.

(Read before the British Association, Sept., 1881.)

THE most economical size of the copper conductor for the electric light or for the performance of mechanical work would be found by comparing the annual interest of the money value of the energy lost in it annually in the heat generated in it by the electric current. The money value of a stated amount of energy had not yet begun to appear in the City price lists. If £10 were taken as the par value of a horse-power night and day for a year, and allowing for the actual value being greater or less (it might be very much greater or very much less) according to circumstances, it was easy to estimate the right quantity of metal to be put into the conductor to convey a current of any stated strength, such as the ordinary strength of current for the powerful arc light, or the ten-fold strength current (of 240 webers) which he (Sir William Thomson) had referred to in his address as practically suitable for delivering 21,000 horse-power of Niagara at 300 miles from the fall.

He remarked that (contrary to a very prevalent impression and belief) the gauge to be chosen for the conductor does not depend on the length of it through which the energy is to be transmitted. It depends solely on the strength of the current to be used, supposing the cost of the metal and of a unit of energy to be determined.

Taking the cost of copper at £70 per ton, and the cost of horse-power the same as above, then if the electric work is carried on through a conductor for 12 hours of every day in the year, it would be most economical to have a wire whose sectional area is about one-fiftieth the strength of the conveyed current in webers.

## ILLUMINATING POWERS OF INCANDESCENT VACUUM LAMPS WITH MEASURED POTENTIALS AND MEASURED CURRENTS.

By Sir W. THOMSON and JAMES T. BOTTOMLEY.

Read before the British Association, Sept., 1881.)

THE electro-motive force used in these experiments was derived from Faure secondary batteries, kindly supplied for the purpose by the Société la Force et la Lumière in their London office.

Two galvanometers were used simultaneously, one called the *potential galvanometer* for measuring the difference of potentials between the two terminals of the lamp, the other (called the current galvanometer), for measuring the whole strength of the current through the lamp.

The potential galvanometer had for its coil several thousand metres of No. 50 (B.W.G.) silk-covered wire (of which the copper weighs about $\frac{1}{10}$ gramme per metre, and therefore has resistance of about 3 ohms per metre). Its electrodes were applied direct on the platinum terminals of the lamp.

The current galvanometer had for its coil a single circle of about 10 centimetres diameter of thick wire placed in the direct circuit of the lamp, by means of electrodes kept close together to a sufficient distance from the galvanometer to insure no sensible action on the needle except from the circle itself. The directive force on the needle which was produced by a large semicircular horse-shoe magnet of small sectional area was about 2½ c.g.s., or 15 times the earth's horizontal magnetic force in London. This arrangement would have been better for the potential galvanometer also than the plan actually used for it, which need not be described here. The scale of each galvanometer was graduated according to the natural tangent of the angle of deflection, so that the strength of the current was simply proportional to the number read on the scale in each case.

Three lamps were used, Nos. II. and III. of a larger size than No. I. The experiment was continued with higher and higher potentials on each lamp till its carbon broke.

The illuminating power was measured in the simplest and easiest way (which is also the most accurate and trustworthy), by letting the standard light and the lamp to be measured shed their lights nearly in the same direction on a white ground (a piece of white paper was used); and comparing the shadows of a suitable object (a pencil was used); and varying the distance of the standard light from a white ground till the illuminations of the two shadows were judged equal. The standard used was a regulation "standard candle," burning 120 grains of wax in the hour. The burning was not actually tested by weighing; but it was no doubt very nearly right; nearly enough for our purpose, which was an approximate determination of the illuminating powers of each lamp through a wide range of electric power applied to it. The following results were obtained.

LAMP No. I.

| No. of Experiment. | Cells. | Volts.* | Webers. | Volts × webers × 10 = kilogrammetres. | Horse-power. | Candles. | Candles per horse-power. |
|---|---|---|---|---|---|---|---|
| 1 | 26 | 56·9 | 1·21 | 6·88 | ·093 | 11·6 | 125 |
| 2 | 30 | 65·5 | 1·46 | 9·56 | ·129 | 25 | 194 |
| 3 | 32 | 70·2 | 1·64 | 11·51 | ·156 | 42 | 263 |
| 4 | 33 | 71·8 | 1·74 | 12·48 | ·170 | 38 | 224 |
| 5 | 34 | 74·1 | 1·81 | 13·42 | ·181 | 44 | 243 |
| 6 | 35 | 76·1 | 1·82 | 13·86 | ·187 | 55 | 294 |
| 7 | 36 | 78·0 | 1·99 | 15·52 | ·210 | 63 | 300 |
| 8 | 37 | 80·3 | 2·06 | 16·54 | ·224 | 66 | 295 |
| 9 | 38 | 81·9 | 2·06 | 16·88 | ·228 | 76 | 333 |
| 10 | 39 | 84·6 | 2·06 | 17·43 | ·235 | 82 | 349 |
| 11 | 40 | 87·0 | 2·10 | 18·27 | ·247 | 84 | 340 |
| 12 | 42 | 90·9 | 2·17 | 19·72 | ·267 | 102 | 382 |
| 13 | 44 | 92·0 | 2·17 | 19·96 | ·270 | 89 | 330 |
| 14 | 46 | 99·1 | 2·21 | 21·91 | ·296 | 114 | 385 |
| | | Carbon of lamp broke with same power, immediately after the measurement of the light was completed. | | | | | |

LAMP No. II.

| Experiment. | Cells. | Volts. | Webers. | Volts × webers × 10 = kilogrammetres. | Horse-power. | Candles. | Candles per horse-power. |
|---|---|---|---|---|---|---|---|
| 1 | 40 | 89·7 | 2·207 | 19·8 | ·27 | 49 | 181 |
| 2 | 42 | 93·3 | 2·296 | 22·42 | ·29 | 68 | 234 |
| 3 | 43 | 95·4 | 2·38 | 22·71 | ·31 | 76 | 245 |
| 4 | 44 | 98·8 | 2·49 | 24·60 | ·33 | 101 | 306 |
| 5 | 46 | 103·0 | 2·63 | 27·09 | ·37 | 117 | 316 |
| 6 | 50 | 106·9 | 2·74 | 29·29 | ·40 | 147 | 367 |
| 7 | 52 | 110·8 | 2·85 | 31·56 | ·43 | 189 | 440 |
| 8 | 54 | 117·0 | 2·95 | 34·53 | ·47 | 196 | 417 |
| 9 | 56 | 119·8 | 2·95 | 35·34 | ·47 | 186 | 388 |
| 10 | 58 | 121·8 | 2·98 | 36·29 | ·49 | 177 | 361 |
| 11 | 40 | 87·0 | 2·14 | 18·62 | ·25 | 35 | 140 |
| 12 | 42 | 89·7 | 2·24 | 20·09 | ·27 | 42 | 156 |
| 13 | 60 | 122·8 | 3·06 | 37·58 | ·51 | 186 | 365 |
| 14 | 62 | 126·0 | 3·13 | 39·44 | ·53 | 180 | 340 |
| 15 | 66 | 132·4 | 3·24 | 42·89 | ·57 | 222 | 383 |
| 16 | 70 | Carbon of lamp broke. | | | | | |

LAMP No. III.

| No. of Experiment. | Cells. | Volts. | Webers. | Volts × webers × 10 = kilogrammetres. | Horse-power. | Candles. | Candles per horse-power. |
|---|---|---|---|---|---|---|---|
| 1 | 40 | 82·3 | 2·85 | 23·45 | ·31 | 68 | 219 |
| 2 | 50 | 101·8 | 3·90 | 39·70 | ·54 | 195 | 361 |
| 3 | 60 | Carbon of lamp broke. | | | | | |

Some of the irregularities of the results in the preceding tables are very interesting and important, as showing the effect of the blackening of the glass by volatilisation of the carbon when too high electric power came to be applied.

The durability of the lamp at any particular power must be tested by months' experience before the proper intensity for economy can be determined.

* The volt is approximately equal to the difference of potentials corresponding to 93 Daniell's cells.

## ROTATIONAL CO-EFFICIENT IN METALS.

By Dr. E. H. HALL, of Baltimore, U.S.

(Read before the British Association, September, 1881.)

THIS paper had reference to a discovery made about two years ago at the John Hopkins University, Baltimore, by which it was shown that when a conductor bearing a current of electricity is subjected to a magnetic force at right angles to the direction of the current a transverse electro-motive force is set up in this conductor, the direction of the transverse force being perpendicular to the plan of the primary current and the magnetic force. The term "rotation co-efficient," as here used, means the transverse electro-motive which would be set up in a conductor of square section of unit area, bearing the unit electric current, when acted upon by the unit magnetic force. Several articles upon this subject have already been published; but the present communication gives some newly discovered facts connected with the matter.

Sir Wm. Thomson said this was by far the most important work of the sections.

## ELECTRIC LIGHTING FOR COAL MINES.

By ANDREW JAMIESON, C.E.

(Read before the British Association, September, 1881.)

MR. JAMIESON said that in the discussion which followed the exhibition of Swan's lamp at the *soirée* of telegraph engineers in October last, Professor Tyndall remarked that probably this form of incandescent lamp could be adapted for use in coal mines as a safety lamp. Since then two practical trials had been made with that object in view—one at Pleasley Colliery, near Nottingham, by Messrs. R. E. Crompton & Co., in conjunction with Swan's Electric Light Company, about the middle of June; the other at Earnock Colliery, near Glasgow, by Messrs. D. and G. Graham, of Glasgow, for Mr. Watson, the proprietor, on August 9 and 11. These trials had created not only a scientific, but also a commercial as well as a general and public interest. The circumstances in which the lighting had to be produced and maintained were new, and differed in many respects from those in which it was now being carried out above-ground in our halls, houses, and open spaces. Dangers and difficulties peculiar to the situation had to be guarded against or overcome, such as explosive gases, subsiding walls or seam roofs, continuous darkness, &c. Long lengths of leading wire had to be dealt with, involving many branches or offshoots, requiring considerable mechanical skill and still more electrical knowledge before a suitable distribution of the electric current was effected and the desired uniformity and intensity of light obtained. Particular interest was at present being manifested by mine owners, managers, and engineers to know the commercial value of the light, or, in other words, whether the possible increased light and safety of Swan's lamps over the methods hitherto adopted would result in an economy and in an

increased output of coal for the same expense of labour. Again, a general and public interest was always awakened in this country when anything was done or even attempted to be done for the benefit of our fellow-creatures, and more especially when this attempt was directed in aid of men who toiled from morning to night or night to morning in the ever dark, dingy, and dismal bowels of the earth in order to provide us with the means of supplying ourselves with coal. Mr. Jamieson reviewed in detail what had been done at Pleasley and Earnock Collieries, explaining the apparatus and appliances adopted at the latter by means of a large wall diagram, which he had made from a scale plan kindly sent to him by Mr. Gilchrist, the manager of Earnock. He showed working models of strong miners' lanterns encasing Swan's lamps, and of air-tight contact-makers of various designs and patterns for preventing the inevitable spark (which always takes place upon disconnecting leading wires or lamps), from causing danger in a fiery mine. He pointed out and showed by calculation and sketches on the blackboard that the plan of joining up another of Swan's lamps in single parallel with a self-exciting Gramme, Siemens, or other form of dynamo-machine, was neither the most economical nor handy for management from the fact that the lamps required to be specially ordered and made a slightly decreasing resistance in proportion to their distance along the main leads from the generator, and that without a costly and delicate current-regulator, there was considerable risk of spoiling the remaining lamps upon turning out a number of them. He said the plan of introducing an equivalent resistance to that of the lamps turned out was equivalent to throwing away so much energy or coal, because the resistance so introduced absorbed power equal, in fact, to that of the lamp or lamps which it replaced. Finally, he gave several plans for joining up the lamps which, in his opinion, were more economical and better; and he stated that by using Siemens' dynamo excitors with their alternate current machines, the danger accruing from suddenly turning out a number of lamps was avoided, as the electromotive force remained practically constant with a low resistance lead and generator coil, and therefore the current passing the remaining lamp or lamps was always the same. For example, if 49 lamps out of 50 were suddenly switched out of circuit, the remaining lamp would not be endangered, and would have the same current passing through it and give the same light as before. He reviewed in detail the most approved mechanical and electrical apparatus for installing electric lighting in coal mines, and mentioned that he had found by experiment that good Swan lamps would give forth light at the rate of 220 candle-power per horse-power absorbed by them.

## THE LACHAUSSÉE-LAMBOTTE DYNAMO MACHINE.

By A. GUEROUT.

THE "lampes soleil," which are in action at the Palais de l'Industrie in the picture-gallery and in the Belgian section beneath the south gallery, are worked by a peculiar form of machine devised by MM. Lachaussée and Lambotte, of Liège.

A machine of this description is exhibited beneath the south gallery, close to the alternate current Gramme machines, and another pattern a little further off, under the same gallery. This machine is represented in perspective by fig. 1.

It is composed, like the alternating current machine of Siemens, of a disc of bobbins of an oval form (fig. 2) placed between two circular rows of electro-magnets. But in the Lachaussée machine it is the electro-magnets and not the oval bobbins which are movable, besides, these last have plates of soft iron as a core, and consequently themselves constitute true electro-magnets of a special form.

The connecting parts of these bobbins and of the pieces necessary to support them, form a drum occupying the centre part of the machine. From edge to centre these oval bobbins are held between two discs of wood screwed on a central axle; towards the circumference they are fixed in grooves in movable pieces of wood, P (fig. 2), themselves set in openings in the ring of wood which forms the outside of the drum.

In this way the pieces of wood can easily be taken out, and the bobbins can be easily withdrawn from the drum and changes or repairs made as required. The extremities of the wire of each bobbin are fixed to two pieces of copper, where they are secured by screws. To these same pieces are fixed also the wires, B, B', which pass together under a lining of brass surrounding the drum and fixed by the upper part of the machine to terminals set on a plate; the same arrangement is adopted for all the bobbins, and each one of them has beneath the upper plate a pair of terminals which correspond to them. Six strong tie-pieces support this drum from each side, and maintain it at an equal distance from two supports, which form the base of the machine.

The inducing electro-magnets, 12 on each side, are mounted on two plates fixed to an axis and movable with it. The current arrives at the inductors by two brushes, and these inductors are joined up in tension so that two consecutive electro-magnets have always contrary poles, and so that the poles of two magnets, facing each other on either side of the drum, are likewise of opposite polarity.

The apparatus is completed by a small Gramme machine which excites the inductors. Finally, large oil cups keep the bearings properly oiled.

As the outside wires of each bobbin correspond to two of the terminals of the upper plate, it is easy to group these bobbins in various ways. At the exhibition the groups are so arranged that one bobbin is taken for one lamp, two bobbins for two lamps, and so on. In this arrangement, care must always be taken to couple together those bobbins which, at the same moment, are traversed by currents of the same kind; and if there are two consecutive bobbins which at the same moment are traversed by currents of a reverse kind, the connection must be made on to the terminals, so that these currents flow together. At the Palais de l'Industrie, one of these machines works 12 "lampes soleil," with an arc of 20 millimetres. The power absorbed according to a measurement made by MM. Wezer and Richmond, is equal to 24 horses.

The principal advantage of the Lachaussée-Lambotte machine consists in the peculiar mounting of the induced bobbins, which allows of their being so easily replaced, and in the facility with which they can be grouped in various ways. The inventors call attention to the circumstance that the turning discs of the electro-magnets having a considerable mass prevent irregularities from the slipping of the driving belt.

On the other hand the rotation of these discs produces a very disagreeable roaring, but the inventors of the "lampe-soleil," who have a licence for the construction, at Paris, of the machine, and who have already made several improvements, think that there will be no difficulty in getting rid of the noise by inclosing the inductors in a peculiar kind of envelope. It is true

that the movement of the machine transmits, telephonically, a sufficiently great noise to the arc itself, but the stifling of this in the lamp renders the inconvenience insignificant.

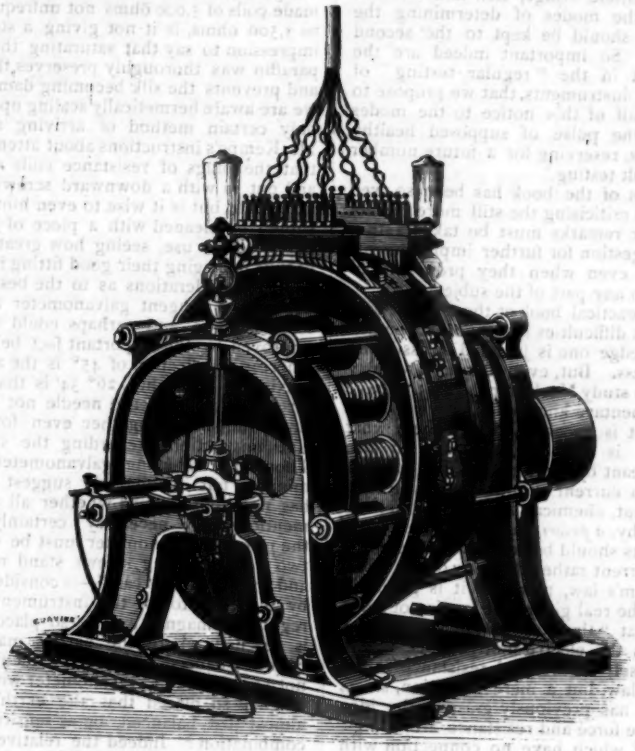


FIG. 1.

As regards the problem of obtaining the maximum effect with the least possible weight, it is certain that the Lachaussée-Lambotte machine is very far from a

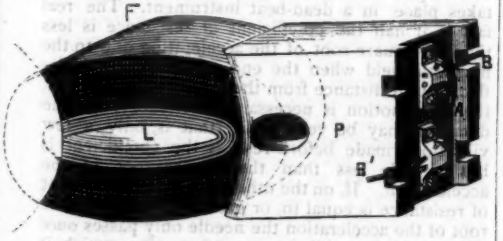



FIG. 2.

solution of the same, but there are cases where stability and ease of repair are qualities sought for, and from this point of view the machine possesses decided advantages.

We will conclude by referring to an experiment which has been made with this machine: two experiments were made, in one of which the soft iron bars were removed from the bobbins, whilst in the other they were kept in. In the latter case the effect was very much more powerful than in the former.—*La Lumière Electrique.*

[A Lachaussée-Lambotte machine and several "lampes-soleil" are at present at work at the Royal Aquarium, Westminster.—ED. *Tel. Jour.*]

## Review.

### A HANDBOOK OF ELECTRICAL TESTING.*

THE duties of a tester of telegraph lines may, like those of a doctor, be classed under two heads—the first the preservation of a healthy state—the second the prompt discovery and eradication of disease when it comes on. And just as it is proper that a medical student should not attempt the study of

*By H. R. Kempe. London, E. and F. N. Spon, 16, Charing Cross.

disease until he has made himself quite familiar with the laws of health, so it is correct that Mr. Kempe's book on testing should commence, as it does, with chapters on resistance coils, galvanometers, the Wheatstone bridge, &c., and that the consideration of the modes of determining the positions of faults should be kept to the second half of the book. So important indeed are the methods employed in the "regular testing" of telegraph lines and instruments, that we propose to confine the first half of this notice to the modes used for feeling the pulse of supposed healthy electrical apparatus, reserving for a future number the subject of "fault testing."

The first edition of the book has been so well appreciated that in criticising the still more perfect second edition our remarks must be taken rather in the light of suggestion for further improvements than as dispraise, even when they propose considerable change in any part of the subject.

In writing any practical book at the present day, one of the greatest difficulties is to know how much elementary knowledge one is justified in assuming the reader to possess. But, even although we may assume those who study Mr. Kempe's book to have at least some elementary knowledge on electricity, we think that if it is necessary to tell them what Ohm's law is, it is certainly necessary to also explain what is meant by the strength of a current. For, seeing that a current produces many totally distinct effects, heat, chemical action, &c., there is no more reason why, *à priori*, the magnitude of any one of these effects should be selected as the mode of measuring a current rather than any other. The writer quotes Ohm's law, much as it is given in other books, but the real gist of the law is not made clear. To say that "the strength of the current varies directly as the electro-motive force of the battery and inversely as the total resistance in the circuit" is not a law, but a mere definition, since, unless a student has previously grasped the idea that electromotive force and resistance are things, the magnitude of which have no connection with the particular strength of current employed, and unless he has a clear conviction that ordinary galvanoscopes do not *measure* currents by the degrees marked on them, he will quite fail to realise the spirit of Ohm's law. When, for example, it is said that the resistance of the electric arc equals the electromotive force between the carbons divided by the current, this is not an example of Ohm's law since it is a mere definition of the resistance of the arc. Resistance in such a case is a mere name given to a ratio—electromotive force divided by current—which for the same distance between the carbons actually varies with the current. Although resistance unlike electromotive force cannot be measured without a current flowing through the circuit, still the pith of Ohm's law depends on the resistance of a conductor being regarded as having a sort of independent existence quite apart from the current.

Under the head of resistance coils, the author says, the object of the "double winding" is to eliminate the induced current. But surely, remembering that with the ordinary bridge key the current is first sent through the coils before the galvanometer is put into circuit, and thus the effects of self-induction are avoided, the double winding is quite as much to prevent the coils acting as solenoids, and so causing a deflection on a delicate galvanometer, should they happen to be near it. Again, when it is remembered that in Rangoon, and in other damp countries, carefully made coils of 5,000 ohms not unfrequently go down to 3,500 ohms, is it not giving a student a wrong impression to say that saturating the "coils in hot paraffin wax thoroughly preserves their insulation, and prevents the silk becoming damp?" As far as we are aware hermetically sealing up the coils is the only certain method of arriving at this result. Mr. Kempe's instructions about attention being paid that the plugs of resistance coils are quite clean and put in with a downward screwing motion are admirable, but is it wise to even hint that the plugs should be cleaned with a piece of glass, or emery paper before use, seeing how great is the chance of thus damaging their good fitting?

The considerations as to the best deflections to use with a tangent galvanometer are clearly and forcibly given, and perhaps could only have been improved by the important fact being added that, whereas a deflection of 45° is the angle that gives maximum sensibility, 26° 34′ is that for which the error arising from the needle not being infinitely small vanishes altogether even for long needles. The instructions regarding the setting up of a Thomson's reflecting galvanometer are clear and minute, but instinctively suggest that the writer has not himself tried whether all the precautions mentioned are necessary; certainly we know that the rule—a galvanometer must be set "so that the two front levelling screws stand north and south, and the front faces east"—is considered unnecessary by the inventor of the instrument. Again if the regulating magnet can be so placed "that a point is reached where the earth's magnetism is just counterbalanced," will not a student ask why should not a single needle galvanometer with the regulating magnet so placed that the earth's magnetism is almost just balanced, be as sensitive as an astatic combination? Indeed the relative advantage of a single needle in a weak field, and an astatic combination in a stronger field, we do not remember to have ever seen treated in any book.

The statement that in a "dead-beat" galvanometer "the mirror, instead of over-shooting the mark and then recoiling turns straight to its proper position and stops dead" fails to give the exact action that takes place in a dead-beat instrument. The real fact is if half the co-efficient of resistance is less than the square root of the acceleration due to the magnetic field when the end of the needle is deflected unit distance from the equilibrium position, then the motion is necessarily oscillatory, but the damping may be very great (that is, only a few vibrations made before rest) if the co-efficient is but a little less than the square root of the acceleration. If, on the other hand, the co-efficient of resistance is equal to, or greater than the square root of the acceleration the needle only passes once through the equilibrium position, after which it reaches a position of greatest elongation, and then returns towards the position of equilibrium which it never reaches. But in no case can it be said "not to overshoot the mark and turn straight to its proper position and stop dead."

Chapter IV. on shunts as well as the description

in Chapter XI. of the error arising from the use of shunts in measuring capacity (and which is so important that it merits a special reference in the index) is remarkably good; indeed the author has made the subject of shunts so throughly his own that any student who wishes to throughly grasp this subject should refer to Mr. Kempe's book.

The paragraph on page 52, "If we employ very high resistances to measure a low resistance, a considerable alteration in the former would produce but little alteration in the current flowing through the galvanometer," is one beginners should take to heart so as not to fall into their habitual error of attempting to weigh a few grains of dust with a weighbridge suitable for weighing a railway truck, an error which appears absurd enough when put in that form, but which is constantly being made in electrical measurements from a beginner forgetting that a small coil of 5,000 ohms bears to the resistance of a bit of thick wire about the same proportion that a ton bears to the weight of a few grains.

Thomson's method of measuring the resistance of a galvanometer without the employment of an auxiliary galvanometer is carefully considered, and "the best condition for making the test," as well "as the possible degree of accuracy attainable," entered into at considerable length, but we do not see it mentioned that the method must necessarily in practice be only comparatively rough, seeing that if the galvanometer be sensitive an extremely weak current must be used, otherwise the deflection will be off the scale, in fact this test has the objection that was possessed by the old method of testing with an electrometer the insulation of a cable by loss of charge. If the electrometer was sensitive the potential to which the cable was charged had to be very small, and, although a larger potential could be employed if the electrometer was more unsensitive, the rate of motion of the spot of light over the scale was not, of course, thereby increased. Prof. Jenkins' inferred zero method, described by Mr. Kempe, on page 227, was devised to overcome this difficulty; but we do not think attention is quite sufficiently drawn to the fact that its whole value consists in its affording a means of using a high potential with a delicate electrometer and so of obtaining a high degree of sensibility.

Chapter VI., on the measurement of the internal resistance of batteries, is extremely complete, and here, as in all other parts of the book, the author calculates in each case the "best conditions for making each test" and "the possible degree of accuracy attainable," but we cannot help noticing what must strike a reader when reading almost any portion of this work, viz., that a valuable addition might have been made by giving a quick indication as to which of the many methods described should be practically employed in any particular case. The same remark applies to Chapter VII., on the "Comparison of the Electromotive Forces of Batteries," and which contains a carefully written account of some ten distinct methods of performing this test, for we fear that in this *embarras de richesses* a student would feel himself quite unable to select the method he ought to adopt.

Chapter VIII., on "the Wheatstone's bridge," is very complete and contains a large amount of very valuable information. As in other parts of the book there is a frequent reference to the work done by people in England—we presume it is patriotism which has prevented Mr. Kempe referring to the additions made to our knowledge of the Wheatstone's bridge by foreigners, especially by Mr. Schwendler of the Indian Government Telegraph Department, who has taken so active a part in devising methods of testing and in carrying them out, in fact, in reducing the testing of telegraph lines to a science. But we venture to think that the "equilibrium method," page 148, the calculation of the proper resistance to give to a galvanometer in a Wheatstone bridge, page 311, &c., which are usually attributed to Mr. Schwendler should either have been credited to him or a misconception removed by the real names of their authors being given.

We agree with the author in his precautions, page 176, "Particular care should be taken, when procuring the keys, to see that the terminals, &c., are not fixed on the top of the ebonite pillars by means of bolts running right through them, as in such a case the advantage of the pillars is entirely lost, and the terminals might just as well be screwed direct into the base board." We would have liked him to add—nor should a hole be ever bored right through an ebonite pillar, since although the screw holding on the terminal at the top does not touch the screw which is put in from below, to fasten the ebonite pillar to the base board, still the sides of the hole may possibly be dirty with oily brass particles, so that no cleaning of the outer surface of the ebonite can possibly make the pillar insulate. Another wise precaution, it would be well to add, is that all the connections in a high insulating key should be above the base board and quite clear of it, since good surface insulation of a pillar is useless if there are badly insulated connecting wires imbedded in the base.

"A very convenient form of condenser, manufactured by Messrs. Warden," sounds antique, and the suggestion that "the shunts should be inclosed under the glass shade so that they may have the same temperature as the galvanometer coils" is, we fear, not a sufficient precaution against the error likely to arise from the considerable change in the resistance of copper wire arising from a small change in temperature.

Under the head of "Joint Testing" it is stated, on page 262, that "when possible it is best to make joint tests by means of an electrometer as the results are always more trustworthy than those obtained by the condenser method," since they are free from the error arising from a small residual charge in the condenser. But surely the great value of the electrometer when used for joint testing arises from the fact that *potential* and not *quantity* is measured. It may require a considerable quantity of electricity to leak from the joint into the insulated joint trough and attached condenser before a decided deflection could be obtained with even a delicate galvanometer, whereas if the joint trough has, like the quadrants of the electrometer, a small capacity, the smallest leakage through the joint raises the potential of the insulated trough, and becomes noticeable.

On page 315, under "Specification for Manufacture of Cable," we find a "coating of Chatterton's compound being placed next the conductor and between each layer of percha." But would not an electric engineer of the present day rather forbid than require the employment of Chatterton's com-

pound? Again "an electrometer test for fall of charge is also sometimes taken as a check," hardly represents the system of testing now employed, seeing that all the tests both for insulation and for capacity, made by the engineers, of all the coils used in the construction of some long submarine cables, have been performed by the aid of an electrometer only.

After reading carefully the many chapters of this book on normal testing (those on fault testing will, as already mentioned, form the subject of a future article), we find ourselves filled with admiration at the large amount of most valuable information this book contains, but at the same time we do not think Mr. Kempe has done himself justice, since there are indications of an apparent absence, either of actual practice in testing or in imparting information to students, for whom of course such a book is specially intended.

September. W. E. AYRTON.
JOHN PERRY.

## Correspondence.

### ELECTRIC LIGHT.

*To the Editor of* THE TELEGRAPHIC JOURNAL.

SIR,—In your Journal for the 1st inst. I notice that "Electron" seems to question whether the incandescent lamp really possesses true illuminating power at all; yet he states that they are perhaps suited "for the small cabins of ocean steamers." A visit to the Paris Exhibition, where he will see many of the Swan lamps, will perhaps convince him that they do possess some illuminating power. Further, he states that the "20 horse-power engine which drives 60 lights on the Thames Embankment of over 200 candle-power each would hardly, I believe, suffice to drive 40 incandescent lamps." If this be so, all that I can add is, that electrical lighting in London must be very far behind what we have in the north. I know of a certain form of dynamo-machine which will, with an expenditure of 20 horse-power (actual) light 200 of Swan's lamps and furthermore do so without the slightest flicker, also there is no heating of the armature.

As to "Electron's" statement about the illuminating power of the lamps sold, they must be judged by the space lit up. The proof of the pudding is in the eating.

If the lamp referred to by "Electron" was tested by the ordinary Bunsen photometer, the results obtained may be accounted for, as it is useless in testing any light over 100 or 150 candle-power.

Yours truly,
JOHN E. CHASTER.

35, Ward's Buildings, Deansgate, Manchester.

## Notes.

ELECTRIC LIGHT IN THE FRENCH LIGHTHOUSES.—Four of the most important French lighthouses have already been provided with very powerful electric apparatus and with machinery for furnishing sound signals during stormy or misty weather. It is proposed to apply similar apparatus to the forty-two others. The total cost is estimated at 7,000,000f. (1,400,000 dols.) for the electricity, and 1,000,000f. (200,000 dols.) for the fog horns. This expenditure is very light in view of the protection which it will afford to the immense capital represented by the 225,000 ships which annually visit the French harbours.—*Les Mondes.*

ARCTIC TELEGRAPH LINE.—The new submarine cable, the most northerly in Europe, is to be laid between Thurso, in Caithness, and Iceland, passing by the Faroe Islands. The chief office in Iceland will be at Reikiavik, and the line will connect with Stappen, the chief town of the Vester-Amt, and with the Madruvel, in the Norder-Amt. The estimated cost of the cable, the plans for which have been prepared at Copenhagen, is about £260,000.

NEW PORTABLE BATTERY.—A very compact and powerful battery has been recently patented by Mr. Marcus A. Hardy, of Newport, R.I. It is designed for medical and experimental purposes, and is very convenient and portable. The battery comprises twenty elements, and the cells are made in one entire piece of hard rubber, which is known to be indestructible with proper use. The construction of the battery is such that all of the cells can be filled in twenty seconds from the reservoir forming the base, and the exciting fluid remains in contact with the zincs and carbons only during use. Any number of cells, from one to twenty, may be brought into use as may be required. The battery cell forms the top to a hollow base or reservoir, and from each cell a small tube projects into the hollow base nearly to the bottom. To the base at one end is attached a stopcock, to which is connected a rubber tube terminating in a mouthpiece. At the opposite end of the reservoir there is a screw-capped opening for introducing the exciting liquid. The zinc and carbon plates are attached to brass connecting pieces secured to a common support of hard rubber. The connections are arranged so that the zinc of one cell is in electrical communication with the carbon of the next, and so on throughout the series, and plug connections may be inserted to cut out any number of cells. The fluid is forced into the cells by blowing on the tube, and is retained by turning the cock. The battery power is greatly augmented by blowing fluid into the cells and allowing air to rise in bubbles around the electrodes. This battery is used in torpedo service, and is extremely well adapted to laboratory use.—*Scientific American.*

EDISONIA.—Mr. Edison has, it is said, offered to light some shops at the West-end with incandescent lamps for six months free of all charge.

The great Edison dynamo-machine, which it is said will maintain 1,400 lights, has arrived in Paris from America, and will be in the Exhibition in a few days.

THE ELECTRIC LIGHT BY THE FAURE BATTERY.—On the 16th ult. the first practical application of stored electricity to the lighting of interiors took place in the smoking-room of the Junior Carlton Club. The room is ordinarily lighted by a modified form of sun-burner, with about 25 gas-burners in it. Beneath this has been suspended a shade somewhat like the shade of an umbrella, and in this 15 British incandescent lamps are placed. The light given was very much superior to gas, and the illumination of the room was much purer and softer, and the light actually steadier than with gas. The electricity came from Faure accumulators which were placed in the basement of the building. These had been charged at the Heddon Street works of the British Electric Light Company, and had been brought into the club only a few hours before the lighting-up took place. Each cell of the accumulators is about 15 in. by 9 in. by 4 in. The number of cells was 40. They were sufficiently charged (by Gramme machines) to last about six hours. The light has been brought into the club through the desire of Mr. Martin,

the secretary, to give the members the advantages to be obtained from the use of incandescent lamps. The work is in the hands of the British Electric Light Company, whose engineer, Mr. Radcliffe Ward, personally superintended the work. The result was pronounced most successful.

TELEGRAPHIC COMMUNICATION WITH LIGHTHOUSES.—A requisition, numerously signed, has been forwarded from Ramsgate to the Lord Mayor, requesting his Lordship to convene a public meeting "for the purpose of representing to her Majesty's Government the urgent necessity of establishing telegraphic communication with the lightships, lighthouses, and the shores, and with the object of preventing great loss of life round our coast from vessels shipwrecked or in distress."

THE ELECTRIC LIGHT IN NORWICH.—The Norwich Town Council have agreed to accept the tender of Messrs. Crompton and Co., of London, for lighting several of the principal streets of the city by means of electricity for twelve months at a cost not exceeding £400. It was stated that nearly one hundred gas-lamps would be superseded, and that the extra cost of the light would be only about £100. The cost of this experiment was, it was explained, less than half that of similar experiments made elsewhere; and the experiment already made in lighting the market-place has proved eminently successful.

TELEGRAPHIC COMMUNICATION WITH RONALDSHAY.—A special meeting of the Kirkwall Town Council was held on the 24th ult., for the purpose of considering the subject of telegraphic communication with South Ronaldshay. The presence of the s.s. *Dacia* in the north of Scotland was considered opportune for the laying of the five miles of cable necessary for the extension, and a memorial to the Postal authorities on the subject was decided on.

DUNDEE ELECTRIC LIGHT COMPANY.—At a meeting held in Dundee on the 21st ult., a provisional committee was appointed to form an Electric Lighting and Power Company in Dundee.

The clerk to the Dundee Gas Commissioners reported to a recent meeting, that he had communicated with the English and Scotch electric light companies, and the corporation, and that the general concensus of opinion received was to the effect that the electric light could not and would not be brought into general use, and that the gas companies and commissioners should direct their efforts to utilising gas more and more. After considering the whole matter, the committee resolved that no private companies or other adventurers should be allowed to supply the light generally in Dundee, and that if the use of the electric light was desired, the Commissioners should themselves supply it. With the view of ascertaining its suitability, and the cost of its production, they instructed experiments to be made at an expense not exceeding £200.

THE MAXIM ELECTRIC LIGHT.—The Maxim electric light is about to be introduced into the sorting rooms of the Edinburgh General Post Office.

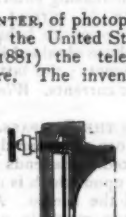
GAS EXHIBITION.—A Gas Exhibition, similar to that recently held in Glasgow, was opened on the 19th ult., in the Marischal College, Aberdeen. The chief features are Swan's electric light, and Pintsch's lighted buoy.

THE SWAN ELECTRIC LIGHT.—A comparative test of the illuminating powers of the Swan electric light, and the Bray gas light, resulted in the former being declared the more brilliant, but at a cost four times that of the latter.

CANADIAN TELEGRAPHY.—A consolidation of Canadian telegraph lines, long talked of, has at last been accomplished. Henceforth what have been known as the Montreal and Dominion Companies will virtually disappear, both having been merged in the Great North-Western, with a view to placing themselves under the control of the Western Union Company of the United States.

TECHNICAL CLASS IN TELEGRAPHY.—A technical class in Telegraphy will be commenced on October 19th, by Mr. Macrae Keith, of the Superintending Engineer's Office of the Postal Telegraph Department, Edinburgh. The class is for the purpose of instructing the Post Office staff of the above town. The subjects dealt with will be:—"The construction, character and difference of the batteries employed in Telegraphy; the measurement of electrical quantities and the apparatus used; the systems in use to increase the capacity of wires for the conveyance of messages; the various modes of joining up circuits; faults—their nature, prevention, and localisation, &c." The formation of classes of this kind is a move in the right direction, and we hope that Mr. Keith's example will be followed in other towns.

MR. SUMNER TAINTER, of photophonic celebrity, has recently patented in the United States (No. 243,657, dated May 14th, 1881) the telephone transmitter shown by the figure. The invention consists of a



combination of a vibratory insulating plate with a layer of conducting particles and conductors, whereby the layer can be included in an electric current.

ELECTRIC PHENOMENA OBSERVED ON DRYING WAX-CLOTH.—H. Hottenroth.—Wax-cloth freely suspended in a drying-room, and exposed to a current of hot air, becomes electric, probably by the friction of the air.—*Dingler's Journal.*

CONSIDERATIONS ON ELECTROGENESIS.—By Signor Nicotra.—A conspectus of the contact, and electromotoric theory of the fundamental experiments, and of the formation of the current. Recent facts and views are not taken into account.—*Wiedemann's Beiblätter.*

POTENTIAL DIFFERENCE OF THE ELECTRIC STRATA WHICH COVER TWO METAL PLATES IN CONTACT WITH EACH OTHER.—M. H. Pellat.—With the decrease of pressure in all gases—air, oxygen, carbonic acid, hydrogen—the potential difference between copper and zinc increases. The change is greatest in oxygen, and slightest in hydrogen.—*Wiedemann's Beiblätter.*

SELENIUM PHOTOPHONE WITHOUT A BATTERY.—By H. Kalischer.—A pencil of rays is thrown upon a preparation of selenium by means of a heliostat or a lens, which is alternately covered by means of a revolving disc fitted with holes. On connecting the selenium apparatus with a telephone the latter sounds. The height of the tone increases with the speed of rotation of the disc. When direct sunlight falls upon the selenium preparation a galvanometer connected with it indicates a current. The lime-light is not strong enough. The introduction of an alum plate does not suspend the action, but a solution of iodine in sulphuret of carbon, as also coloured glasses other than yellow or light brown, have this effect.—*Weidemann's Beiblätter.*

ON THE CHANGES OF THE ELECTRO-MOTIVE FORCE AND THE RESISTANCE OF AN ACTIVE HYDRO-ELECTRIC ELEMENT.—By D. Mazzoto.—The author verifies the proposition that the electro-motor force decreases with the increasing intensity of the current by observations made on a Leclanché or a Volta element. If the parts of a Volta element containing the electrodes are connected with dilute sulphuric acid by means of a syphon the zinc-platinum element is the most variable and the zinc-carbon element the most constant. The magnitude of the changes in a zinc-copper or a zinc-platinum element is of the same order, whilst in a zinc-carbon element they are relatively much smaller and slower. The internal resistance increases as in other elements with an increasing external resistance, or a decreasing intensity of current. The zinc-copper element shows the opposite behaviour. The latter results differ from those obtained by Von Waltenhofen with the same elements; the latter, however experimented with weaker currents. *Wiedemann's Beiblätter.*

IMPROVEMENT IN THE COMPASS.—By F. Miller.—In order to read off more conveniently the position of the needle, there are fixed at its ends two thin horizontal discs of aluminium upon which is drawn a line coinciding with the axis of the needle. A microscope with a cob-web cross, made movable upon the graduated circle and fitted with a vernier, enables this line to be observed. In addition there are fixed at the ends of the needle two vertical discs of paper or mica, by whose friction against the air the vibrations of the needle are moderated.—*Dingler's Journal.*

ON THE QUANTITATIVE DETERMINATION OF THE DEVELOPMENT OF HEAT BY THE GALVANIC CURRENT.—By E. EDLUND.—This determination can be easily effected, proceeding from the proposition formerly established by the author that the electromotive force if traversed by a current consumes or produces a quantity of heat according as the current moves in the same direction as its own direction of action or in the opposite, and that in either case the quantity of heat consumed or produced is proportional to the product of the electromotive force in the strength of the current.—*Wiedemann's Beiblätter.*

THE CITY AND GUILDS OF LONDON INSTITUTE.—The winter courses of lectures of the above institute will commence during the present month. The Technical Physics classes will be conducted by Professor Ayrton, who will lecture on "Electric lighting and the transmission of power," "Electrical instrument making," and, "Electrical laboratory apparatus."

As a special number of the *Journal* of the Society of Telegraph Engineers, a valuable Guide-Book to the British Section, at the Paris Electrical Exhibition has been issued, edited by Prof. W. E. Ayrton, F.R.S.

OZONE.—The abbé Moigno has suggested that in view of the enormous development of electricity that takes place from the running of so many dynamo-machines, in the Paris Exhibition, experiments should be made in the building to determine the effects of the currents in developing ozone in the atmosphere.

THE ELECTRO-TECHNICAL SOCIETY OF BERLIN.—The Electro-Technical Society of Berlin (*Electrotechnischer-Verein*) offers a prize of a thousand marks (shillings) for the best essay on the transmission of power by electrical and mechanical means, which must be sent in before the 1st of October, 1882.

ON THE ENERGY OF TELEPHONIC CURRENTS.—By M. Pellat.—A condenser of the capacity of $\frac{1}{4}$ microfarad was charged and discharged 160 times in a second by communication with two points of a circuit, into which a telephone was introduced. If $c$ is the capacity, $v$ the potential difference of the coatings, the energy will be $\frac{1}{2} c v^2$, and for $n$ charges and discharges the energy expended $= n c v^2$. If $v$ is reduced to 0·0005 volt, a sound is still heard in the telephone, though the energy is so small that it would require 10,000 years to produce a microcaloric, *i.e.*, to raise 1 grm. of water 1° C. With this small expenditure of heat a telephone can be made to sound for 10,000 years.—*Wiedemann's Beiblätter.*

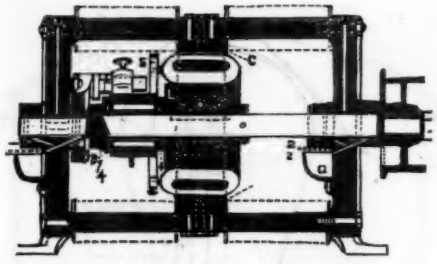
BRIGHTON EXHIBITION.—The exhibition of sanitary, domestic, and scientific appliances, to be held in the second week of December at Brighton, is to include also a competitive exhibition of electric lighting.

INTERNATIONAL ELECTRIC EXHIBITION AT THE CRYSTAL PALACE.—It is intended to hold an exhibition at the Sydenham Palace, from December next to March, 1882. Applications for space, English and foreign, should be made to the Manager, Crystal Palace. Printed forms of application for admission can be had from the Manager, Crystal Palace, Sydenham, London, or at the Hôtel Chatham, Rue Neuve St. Augustin, Paris. The principal objects to be admitted are comprised in the following:—*a.* Apparatus used for the production and transmission of electricity. *b.* Magnets, natural and artificial. Mariners' compasses. *c.* Applications of electricity. Exhibits will be received on and after 21st November, 1881. Exhibitors will not have any rent to pay, but must at their own expense place and decorate their exhibits. Motive power will be supplied free of cost to the exhibitors applying for it. The exhibitors must provide attendants for the proper cleaning of their exhibits and space. The expenses of removing and bringing back the cases will be borne by the exhibitors. The question of medals and certificates will be settled hereafter. It is a question whether the glory of the Paris Exhibition can in December be immediately transferred to the pleasure palace on the outskirts of London. One thing is certain, that the Crystal Palace management, to make success certain, should be as liberal as possible to intending exhibitors. It is reported, but we know not on what authority, that many promises have already been obtained from exhibitors at Paris. Some exhibitors at Paris will consider it little trouble to pass their exhibits from the one show to the other, whilst others will probably consider that for one year, at least, they have had enough of trouble and expense.

ELECTRIC LIGHTING BY WATER POWER.—An experiment was made at Godalming, on the night of the 26th ult., to light a portion of the town by electricity generated by a water wheel. One large Siemens' lamp and several of Swan's small incandescent lights were

in use, and the illumination was deemed highly satisfactory. It is proposed to fix turbines, which the little River Wey will drive at considerable velocity, giving power for a number of lights to supply the Charterhouse Schools, Godalming, and probably Guildford. In the daytime electricity can be stored in Faure accumulators.

A PATENT (No. 245,040 dated Feb 4th, 1881) for the magneto-electric machine, shown by the figure has been taken out in the United States by James J. Wood. The chief points in this machine relate to the commutator, which is composed of plates having their ends bevelled, the bevelled portion being held by grooved plates, the groove being filled with insulating material.



One of the grooved plates is attached to the tube which fits on the armature-shaft. The other plate is forced against the commutator-plates by a nut on the tube. Extensions from the commutator-plates are provided with binding-screws for the attachment of the armature wires.

## New Patents—1881.

3926. "Secondary batteries or magazines of electricity." J. S. SELLON. Dated September 10.

3929. "An improved system of multiplex and self-convertible 'teleradiophone.'" E. J. P. MERCADIER. Dated September 10.

3932. "Dynamo or magneto-electric machines." P. JENSEN. (Communicated by T. A. Edison.) Dated September 10.

3944. "Improvements in telephones, in part applicable to other electrical apparatus." W. E. IRISH.

3946. "Telephones." W. E. IRISH. Dated September 12.

3975. "A new or improved mode of and appliances for carrying and laying electric wires." J. W. SMITH. Dated September 14.

3976. "Electric arc-lamps." P. JENSEN. (Communicated by A. J. B. Cance.) Dated September 14.

3987. "Secondary batteries or magazines of electricity." J. S. SELLON. Dated September 15.

4005. "Storing electricity." J. S. SELLON. Dated September 16.

4011. "Electric lamps." B. HUNT. (Communicated by A. E. Brown.) Dated September 17. (Complete.)

4017. "Improvements in electric lamps, in electrodes therefor and in fitting up the same." A. HALLETT. Dated September 17.

4019. "Generating dynamic electricity." G. E. DERING. September 17.

4024. "Electric lamps." W. MORGAN BROWN. (Communicated by E. M. Fox). Dated September 19.

4026. "Dynamo-electric and magneto-electric machines." E. DE PASS. (Communicated by La Société Anonyme des Câbles Electriques, système Berthoud, Borel et Cie.) Dated September 19.

4029. "A new construction of telephone transmitter." S. PITT. (Communicated by H. Machalski.) Dated September 19.

4034. "Dynamo or magneto-electric machines and electric motors." P. JENSEN. (Communicated by T. A. Edison.) Dated September 19.

4037. "Secondary batteries." W. CLARK. (Communicated by N. de Kabath.) Dated September 19.

4052. "Improvements in and relating to electrical alarm apparatus for the protection of dwelling houses or other structures or places from burglary." H. H. LAKE. (Communicated by H. C. Roome.) Dated September 20.

4057. "Improvements in the production and employment of continuous electric currents in railway carriages, steam-boats, and other vehicles and in apparatus to be used therefor." H. E. NEWTON. (Communicated by the Société Universelle d'Electricité Tommasi.) Dated September 20.

4058. "Improvements in and relating to electrical cables or lines for telegraphic, telephonic, and other purposes." W. H. LAKE. (Communicated by J. B. Henck.) Dated September 20.

4059. "Improvement in electrical bath apparatus to be used for the application of electricity to horses and other animals." H. H. LAKE. (Communicated by B. Barda.) Dated September 20.

4060. "Regulating the discharge of secondary and other batteries." A. M. CLARK. (Communicated by N. de Kabath.) Dated September 20.

4069. "Indicating apparatus or signals for railway switches or points." W. P. THOMPSON. (Communicated by W. W. Gary.) Dated September 21.

4070. "Indicating apparatus or signals for railway switches or points." W. P. THOMPSON. (Communicated by W. W. Gary.) Dated September 21.

4078. "Alarm signals for railway carriages and for other purposes." J. NORRIS. Dated September 21.

4093. "Electric cables." E. G. BREWER. (Communicated by P. B. Delany and E. H. Johnson.) Dated September 22.

4107. "An improved dynamo-electric machine." F. E. FAHRIG. Dated September 23.

4127. "An improved fire alarm wire or indicator." B. J. B. MILLS. (Communicated by P. A. Charpentier.) Dated September 24.

4128. "Methods or apparatus for distributing and regulating the transmission of electrical power." J IMRAY. (Communicated by M. Deprez and J. Carpentier.) Dated September 24.

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

200. "Transforming, conveying, &c., power by means of electricity," &c. JOHN IMRAY. (A communication from abroad by Gustave Eugène Cabanellas, of Paris.) Dated Jan. 15. 1s. Relates to means and apparatus for transforming, conveying, and applying power by means of electricity, the objects aimed at

being as follows:—(*a.*) The distribution by a single conducting system among any number of consumers along the line of the energy disposable at various points, in such manner that the forms under which the energy is locally consumed may differ, and that the local consumption may be increased, diminished, or arrested at the will of the consumer, whilst nevertheless the regulation of all the local supplies of energy is subject to a single regulation effected automatically at the supply station, so arranged that the quantity of energy produced exactly suits the total demand along the line. (*b.*) The distribution by electricity over any distance and among any number of receivers of the speed and direction of prime movers in such manner that local receivers connected to one line can utilise predetermined movements in any number or direction, and at the same time distribute arbitrary local forces.

264. "Apparatus for producing light by means of electric currents," &c. ALFRED APPS. Dated Jan. 21. 6d. The invention consists of three parts:—1st. The object of this invention is to secure increased facilities for obtaining a correct measurement of the currents passing through an induction coil, primary, or other magnetic or induction apparatus, by the attachment of a special dynamometer constructed with gauge, and indicating in customary measurements of force the maximum power or variations of the currents or charges. 2nd. This part of the invention consists of the multitubular form and make of magnet and of conductor contained within the inductor, securing better insulation than heretofore. 3rd. The invention relates to the separation or arrangement of the currents or charges in the parts of the conductors in or about the induced field, and the utilisation of the discharges to produce light in passing through rods, filaments, tubes, or plates of carbon or carbonised material or other conducter placed between two holders, the lower one being stationary, and the upper drawn down by gravitation, and making by solid or fluid means a good metallic connection, the moving holder being held so as to secure the requisite axis of the parts. Fig. 1 represents in elevation the improved

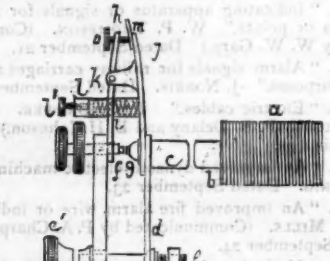



FIG. 1.

construction of dynamometer arranged according to the first part of the invention. In this fig. *a* is the primary or other coil, electrical or magnetic, but if the magnetic power be produced by other means, then the apparatus to measure and regulate the action is equally applicable. *b*, is an iron core opposite to which is the solid iron cylinder, *c*, or other suitable magnetic body fixed to the plate spring, *d*. This spring plate is pulled or drawn away from the core, *b*, by means of the tension screw, *e*, turned by its insulated head, $e^1$. The platinum studs, *f*, *g*, are by this means brought into contact. In order to know the force with which the studs, *f*, *g*, are pressed together the dynamometer, *h*, is employed; it is of the spring balance kind, and is constructed with two flattened arms, *i*, *j*, jointed at about one quarter part of the whole length distant from one end at *k*. In the central part of the dynamometer, *h*, is fixed a tube, *l*, containing a spiral spring which is forced up by a regulating screw, $l^1$. A little pin projecting from the end of the spiral spring through a slot in the tube, *l*, indicates in ounces and pounds the tension required to press inwards the longer ends of the two arms, *i*, *j*.

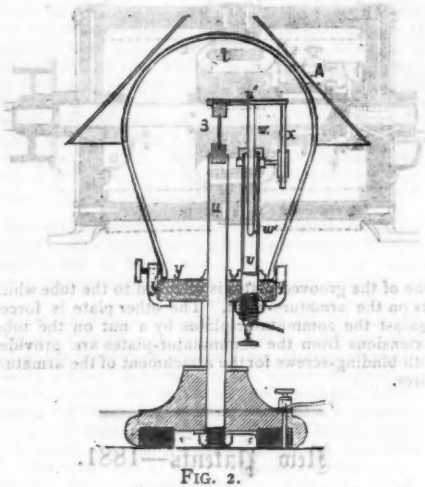



FIG. 2.

These arms are slotted out and placed over the top of the rheotome, which has been previously adjusted to the thickness of the gauge, *m*; then by screwing up the tension screw the force required to separate the studs, *f*, *g*, of the rheotome is indicated on the scale (marked on the tube, *l*) by the pin of the spiral spring before mentioned; the screw, *o*, at the shorter ends of the arms, *i* and *j*, prevents them from opening far enough to derange the said spiral spring. The apparatus by which the production of light is accomplished will be understood on reference to fig. 2, in which *t* is a closed vessel; *u* and $u^1$ are two holders, the holder, *u*, being stationary, and the holder, $u^1$, movable, being drawn down by gravitation, and making by preference a fluid contact in the iron tube, *v*. The rod, *w*, has a platinum stud screwed into the end at $w^1$, by which good contact is made with the mercury contained in the said tube, *w*. A light guide rod, *x*, moving in a suitable guide maintains the proper axes of the parts during the descent of the holder, $u^1$, in relation to *u*. The glass plate, *y*, sustains the rods and fittings, and forms a convenient base. A ring holder, $y^1$, with lugs and suitable screws fixes down the vessel to the glass base plate. The other details are of suitable size and character to facilitate the passage of currents through any carbon or other conducting matter at *z*. The oxygen is consumed quickly on passing a current through *z*, and after this the change in the condition of *z* is very small, but

slight changes may arise from the joint between the base plate and vessel not being quite perfect. A card or glass reflector, A, is placed over the apparatus.

275. "Electric semaphores for railway purposes." W. R. LAKE. (A communication from abroad by Frances Robert Fountaine Brown, of the city of Montreal, Canada.) Dated Jan. 21. 6d. The object of this invention is to provide simple and effective mechanism for operating railway signals or semaphores, and it consists partly in a simple combination of gearing operated by a weight, and so arranged that the strength of the electro-magnet need not be in proportion to the said weight, and the invention further consists in a certain combination of mechanism hereinafter specified. Fig. 1 is a side elevation, and fig. 2

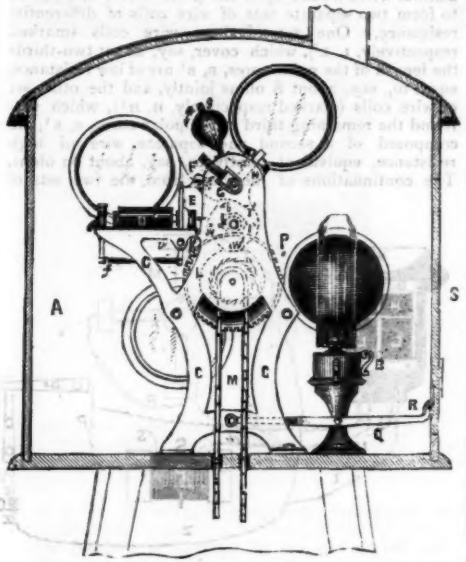



FIG. 1.

a cross section of the invention. A represents a box, which may be made of any material and design suitable for containing the lamp, B, and the mechanism hereinafter described; C is a metal frame for supporting the said mechanism; D is an electro-magnet suitably fastened to the frame, C, and properly connected by wires to a battery and circuit-breaker placed at a point from which the signal should be manipulated; E is a lever pivoted to the frame, C, and provided with an armature, *e*; *f* is a spring placed, as shown, to draw the armature, *e*, from contact with the electro-magnet whenever the current is broken; F is an arm attached to or forming part of the tumbling plate, G, and whose end rests upon the lever, E, when the armature, *e*, is not in contact with the electro-magnet, D. The dog, H, is pivoted on the same pin as the plate, G, but moves independently. One wing of this dog, H, fits into the ratchet wheel, I, and its other wing between two blocks or their equivalent on the tumbling-plate, G. The ratchet wheel, I, is keyed to the same spindle, $I^1$, as the spur pinion, J, which meshes into the spur wheel, *k*. This latter wheel, K, is keyed to the same spindle as the toothed wheel, L, around which hangs the chain, M, upon one end of which a suitable weight is hung. So long as the dog, H, is in gear with the ratchet-wheel, I, the full power and resistance produced by the weight on the end of the chain, M, is sustained by the said dog, and the gearing consequently remains stationary till the dog, H, is thrown clear of the ratchet, when of course the gearing revolves from the action of the said weight. The tumbling plate, G, is so balanced on its spindle by a weight, *g*, or otherwise, that unless supported it will fall in the direction indicated by the arrow, and being placed in the relation to the dog, H, described, strikes it sufficiently hard to knock it out of gear with the ratchet wheel, I, which latter immediately revolves till one of the pins, *k*, placed in its face comes in contact with the arm, *h*, on the tumbling plate, G, which action turns the plate, G, back into the position

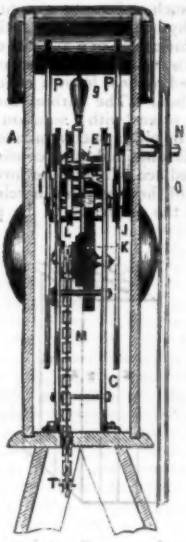
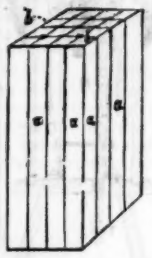



FIG. 2.

from which it has just fallen, carrying with it the dog, H, again into gear with I. The gearing just described is designed to operate the semaphore arm, O, which is keyed to the spindle, N, and geared, as shown, with the spindle, $I^1$, to which the ratchet wheel, I, is also geared; and as this has only four teeth at equal distance apart, each movement of the wheel, I, gives the semaphore an eighth of a turn, the gearing between the two spindles, N and $I^1$, being as two is to one. With the view of signalling at night, on to the spindle, $I^1$, are keyed the spiders, P, having four eyes, each of a different coloured glass. These eyes are so placed that at each stoppage of the wheel, I, one of them remains opposite to a properly protected hole in the box, A, immediately in front of the lamp, B, thus indicating by the colour of the glass the signal which the position of the semaphore arm, O, represents. As it sometimes happens that the arm will be opposite the hole above referred to, corresponding holes are made in the arm, O, so that the signal-light shall not at any time be obscured. To insure the weight being wound up, a lever, Q, is pivoted to the lamp-stand or any suitable place. One end of this lever is forked to allow the chain to pass freely through it, the other end

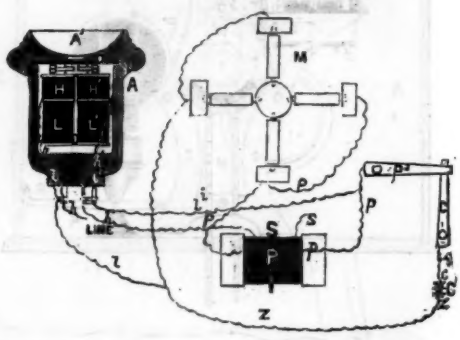
being crooked, so as to engage with the catch, R, secured to the door, S, as shown. When the door, S, is closed, the crooked lever, Q, securely locks it, as the forked end of the lever is heavier than the other. By placing a pin, T, through the chain, M, near the weight, and having no other obstruction on the chain, M, the said chain will pass freely through the forked end, as before referred to, except when the pin, T, comes in contact with it, consequently the door remains locked, except when opened by the pin coming in contact with the lever. By this arrangement it is absolutely necessary to wind up the weight before the door, S, can be opened or the lamp, B, lighted.

304. "Manufacture of carbon and graphite," &c. RICHARD WERDERMANN. Dated Jan. 22. 6d. Relates to the manufacture of carbon, and to the conversion of carbon into graphite for electric light carbons, &c. In order to obtain such carbon or graphite, sugar is carbonised either by heat or by the action of sulphuric acid or hydrochloric acid, or a mixture of sugar is made with essences, oils, resin, tar, or other substances, which when decomposed by heat leave a residuum of pure or nearly pure carbon. The carbon thus or otherwise obtained is then mixed with a solution of pure sugar, or with pure tar or oil, in such a manner that a homogeneous paste is obtained, the consistency of which must be regulated according to the form of the mould or to the length of the draw hole, hereinafter described, through which the paste is to be pressed. In the



manufacture of carbon pencils or electrodes, a moulding press is used constructed with a cylinder, in one end of which is inserted a block of metal or other suitable material. This block, which is shown by the figure, is either made of one piece or of several pieces, and is provided with draw holes, that is to say, holes through or into which this paste is to be forced to give it the required form. When dry the pencils are placed in a vessel containing a solution of sugar, tar, oil, or other suitable carbonaceous liquid. The said vessel has an air-tight cover provided with a cock, and a pipe connected with a vacuum pump. When a vacuum is produced in the said vessel the liquid fills up all the pores in the articles or pieces of carbon, which are now dried again, and when dry are placed into a mould of porcelain, fire clay, magnesia, or other suitable material, the two ends of the said articles or pieces being placed on metal bearings, or being otherwise connected with two conductors leading to the terminals of a generator of electricity, and the carbon is heated by the passage of the electric current to a white heat, whereby it is converted into graphite.

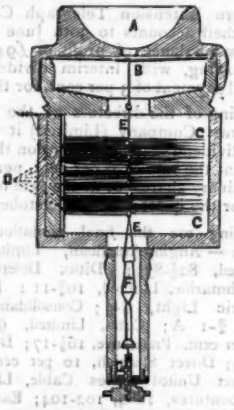
542. "Telephonic apparatus." JULIUS SAX. Dated Feb. 8. 6d. Has reference to the mode of constructing the electro-magnet of a telephone, and of connecting up the same, whereby a single battery is caused to serve both for the telephone and the microphone, such battery being augmented to any required strength. The figuure represents a vertical section of an electro-magnetic receiving telephone with an improved construction of electro-magnet applied thereto to effect the required objects, the microphonic transmitter, induction coils, contacts, and usual appurtenances being shown in connection therewith. A is an electro-magnetic receiving telephone consisting of a casing containing a diaphragm, D, on one side of which is a mouth-piece, $A^1$, whilst on the opposite side of the diaphragm within the casing is an electro-magnet, the general arrangement of the parts being such as is commonly adopted in apparatus of this character. According to the invention, in lieu of using a single wire, the electro-magnet is constructed with two distinct wires wound upon the polar cores, B, $B^1$, so as to form two separate sets of wire coils of differential resistance. One set of these wire coils (marked respectively, L, $L^1$), which cover, say, about two-thirds the length of the polar cores, B, $B^1$, are of low resistance, equal to, say, about 8 ohms jointly, and the other set of wire coils (marked respectively, H, $H^1$), which surround the remaining third of the polar cores, B, $B^1$, are composed of a second and separate wire of high resistance, equivalent jointly to, say, about 80 ohms. The continuations of the wires from the two sets of




coils are connected with a microphone, M, and induction coil, I, and a battery, $C^1$, in the following manner:—The carbon pole, C, of the battery, $C^1$, is connected to the spring, *c*, whilst the zinc pole, Z, is connected by means of the wire, *s*, to one side of the microphone, M, and also by a branch wire, *l*, to the one termination of the low resistance coil; L, upon the pole, B, of the electro-magnet of the receiving instrument. The other end of the wire forming the second portion of the low resistance coil, $L^1$, on pole, $B^1$, is attached to wire, $l^1$, in connection with another spring contact, $p^2$, and also with the branch wire, $p$, communicating with the primary wire and helix, P, of the induction coil, I; the other end of which primary wire is similarly connected to the other side of the microphonic transmitter, M, by the wire, $p^1$. One end of the high resistance coil from, H, is connected to "line" by means of the wire, *h*, whilst its other extremity from, $H^1$, is connected by the wire, $h^1$, to the secondary wire and helix, S, of the induction coil, I, by which it communicates with "earth" by the wire, *s*. The resistance of the low resistance coils should be as nearly as possible equal to that of the primary wire of the induction coil and the microphone together. Under these conditions by the act of pressing the spring contacts, *c* or $p^2$, so as to unite their free extremities the

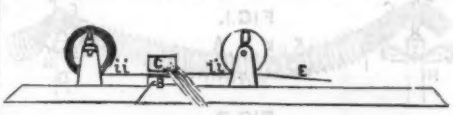
current from the battery, $C^1$, is caused to divide itself owing to the uniformity of resistance so as to flow partly through the microphone and partly through the differential resistance coil so as to charge or influence the electro-magnet of the receiving telephone, whereby one battery is made to serve for both instruments, the strength of the battery being augmented as required.

760. "Improvements in telephones." EDWARD W. ANDERSON. (A communication from John Goodman, of Louisville, in the United States.) Dated Feb. 23. 6d. Consists mainly in so arranging a magnet or series of magnets in combination with one or more resonators or diaphragms, and one or more conductors of electricity or helices, that when a current of electricity is passed through the conductor or conductors it will effect a change of position of the magnet or magnets, and as a result the diaphragm or diaphragms will be thrown into




vibration. In the figure, D represents the magnets, which in this instance are long and tongue-like in form, and are fastened at intervals by one end to the post, H, which is located at the side of the case near one end of the helix or helices, C. In this construction two flattened helices are employed, their long sides being parallel with each other, and one being a left hand, while the other is a right hand helix. These helices are designed to affect the magnets between them in the same manner that a single coil would if it surrounded them, and a single coil may therefore be employed with like effect. The magnets, D, extend between the coils, C, and parallel to the wires thereof, substantially in the manner shown in the drawings, and the extremities of the magnets opposite to the post, H, are left free to move. B indicates the resonator or diaphragm, made of thin metal, or other suitable material, A designates the ear-piece over the resonator, and E a cord, or other connection, extending from the resonator to the spring, F, which is designed to be connected to the case at the opposite end from the resonator. In its course the cord, E, is connected to the middle portions of the magnets, D, which are therefore in a manner strained or held in tension between two elastic devices, the resonator and the spring, F, which tend to hold said magnets parallel with the wires of the coils, C. This tension may be regulated by means of an adjustable screw, G, to which the spring, F, is connected.

1496. "Printing music by electricity." HERBERT YOUNG DICKINSON. Dated April 12. 4d. In this invention one, two, or more wheels are used, one of which (D in the figure) is acted upon by clockwork or a weight, or other suitable motor, so that it moves at a regular rate of speed. Chemically-prepared paper is passed round this wheel often enough to "nip" and so to continuously draw the roll of paper over the table, B, and under the box, C, from the roll or coil made on the wheel, A. Within the box, C, are a set of rulers which rule on the paper, *i*, *i*, as it passes over the printing table, B, five treble staff lines and five bass staff lines. The paper then passes under the pins in C, these being connected by wires with the keys of the instrument played upon. The return wire for the electric current for the stationary pins is attached to the table, B. The movable pins in C are acted upon by electro-magnets. The electric circuits are completed by the depression of the keys of the instrument played upon. When a note of the key-board of the musical instrument is depressed, the movable pin which works in connection with the said note is also depressed, and marks a fine line on the paper. This line will correspond

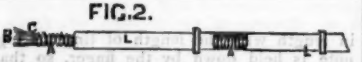



in length with the length of time during which the note is held down by the finger, so that the lines marked on the paper will vary according to the length of time the notes are held down, the position on the paper of the lines so marked will correspond with the position of the notes struck on the key-board. The pins are also so placed that if a note would fall inconveniently high or low, if printed in its proper position, the said note will be printed an octave lower or higher, as the case may require. The depression of these notes will therefore close two circuits, one for printing the note (which is the same one as used for printing the note in a different octave), and one which is common for indicating the octave higher or lower. After the paper passes away from the machine at E, the various notes printed as above described can be valued, and if necessary can be written out or printed in the ordinary musical notation. If more convenient, the paper could be collected round the wheel, D, and uncoiled afterwards. There may be a catch to the wheel, D, so that the machine may be started or stopped at will, or the motive power may be thrown out of gear by any ordinary mechanism for that purpose.

1726. "Electrical call for telegraphic and telephonic purposes." W. R. LAKE. (A communication from abroad by David Hall Rice and Jacob B. Currier, both of Lowell, Massachusetts, United States of America.) Dated April 20. 8d. Relates chiefly to improvements in electric calling and alarm devices to be placed upon telegraphic or telephonic circuits or lines to call and sound an alarm at any one of a number of stations on such circuit without calling and alarming any other station upon the said circuit. The invention comprises the employment upon such telegraphic or telephonic lines, for the purpose of ringing alarms or calls, of vibrating springs or reeds, which are graduated so as to vibrate at given normal rates of oscillation, and an undulatory or broken electric current synchronous with the reed or spring to be actuated, each of the said reeds on a circuit being different from every other, and each being placed at a different station on the said circuit, and operating directly or intermediately upon the bell or alarm mechanism. The transmitting device consists of a contact reed, whose length can be increased

or shortened to the length necessary to give the number of vibratory currents corresponding to the rate of vibration of any particular alarm reed.

2217. "Electrical cables or conductors." W. R. LAKE. (A communication from abroad by Patrick B. Delany, of New York.) Dated May 20. 6d. The object of this invention is to provide a multiple wire electric telegraphic or other cable having great flexibility and strength, and in which the several conductors will be effectively insulated from each other and protected from contact with outside objects, the said cable being adapted for use either in the air or underground. Fig. 1 represents in elevation a portion of aërial or overground telegraphic cable, and fig. 2 is a side view partly in section of a portion of an underground cable constructed according to this invention. A indicates the insulating buttons which support and keep separated the wires. These buttons may be made of glass, porcelain, or any other suitable insulating material, and




of any desired diameter, and each button has a central hole, *a*, for the passage of the supporting and strengthening rope or cable, B. Between the central hole and the periphery of the said buttons, and at a proper distance from such periphery and from each other, are formed the small apertures, $a^1$, for the passage of the conducting wires, C. The outer apertures for the passage of the wires should be at such a distance from the peripheries of the buttons that should the buttons come in contact with the ground, a wall, or other object, the wires will be held out of contact with such object. When the cable is laid underground it is inclosed in an iron pipe as shown by fig. 2.

2398. "Telephones." R. M. LOCKWOOD and W. V. O. LOCKWOOD. Dated May 31. 6d. Relates to the telephone referred to on page 193 of the TELEGRAPHIC JOURNAL for May 15th, 1881.

## City Notes.

Old Broad Street, September 28th, 1881.

DIRECT SPANISH TELEGRAPH COMPANY, LIMITED.—The report of the directors for the half-year ending 30th June, 1881, to be presented at the general meeting of shareholders to be held on Friday, September 30th, 1881, states that the accounts for the half-year ending 30th June, 1881, show a balance to the credit of profit and loss of £7,245 1s. 5d. The result of the half-year's working may be considered satisfactory, the receipts being in excess of those for any previous half-year, except that ending 31st December, 1875, when exceptional circumstances caused a large increase of traffic. The Company's cables and land-lines continue to work perfectly, the high electrical condition of the submarine cables showing no variation. The advantages anticipated from the removal of the cable station from the Lizard to Falmouth have been fully realised. The entire cost of the construction of the land line between Falmouth and the Lizard necessary to effect this removal is shown in the accounts, and is slightly in excess of the estimate of £2,500. The payment of the dividend on the preference shares will absorb £2,921 10s. 0d. of the balance of profit and loss, leaving £4,323 11s. 5d., from which the directors recommend that a dividend be declared of 3s. per share on the ordinary shares for the half-year, free of income tax, being at the rate of 3½ per cent. per annum, and that the sum of £2,302 1s. 4d. be added to the reserve, raising that fund to £5,500, and leaving £81 17s. 1d. to be carried forward to the next half-year.

AMERICAN CABLE COMPANY.—We notified in our last issue, that this Company would commence business on the 15th September; it was not, however, until the 17th that messages were accepted, as the New York offices were incomplete. After one day's cabling, it was reported that a fault had shown itself in deep water; that a fault has occurred is quite true, but we think not in deep water. The *Faraday* has yet to take out the last portion of the second cable for this company.

THE Eastern Extension Telegraph Company announce that their accounts to 30th June last (subject to audit) show a balance of profit of £94,755 for the half-year, allowing, with interim dividends already paid, of a total payment of 3 per cent. for the half-year.

AT a meeting of the directors of the Globe Telegraph and Trust Company (Limited) it was resolved to declare a dividend of 3s. per share on the preference shares, being at the rate of 6 per cent. per annum, and 2s. on the ordinary shares, or at the rate of 4 per cent. per annum, for the quarter ending October 18 next.

The following are the final quotations of stocks and shares: — Anglo-American, Limited, 53-53½; Ditto, Preferred, 82½-83½; Ditto, Deferred, 24-24½; Brazilian Submarine, Limited, 10¾-11; Brush Light, ——; Electric Light, ½-½; Consolidated Telephone Construction, ¾-1 A; Cuba, Limited, 9½-10; Cuba, Limited, 10 per cent. Preference, 16½-17; Direct Spanish, Limited, 5-5½; Direct Spanish, 10 per cent. Preference, 16½-17; Direct United States Cable, Limited, 1877, 10½-10¾; Debentures, 1884, 102-104; Eastern Limited, 10½-10¾; Eastern 6 per cent. Preference, 13-13½; Eastern, 6 per cent. Debentures, repayable October, 1883, 103-106; Eastern 5 per cent. Debentures, repayable August, 1887, 102-105; Eastern, 5 per cent., repayable Aug., 1899, 105-108; Eastern Extension, Australasian and China, Limited, 10¾-11¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 108-111; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 104-107; Ditto, registered, repayable 1900, 104-107; Ditto, 5 per cent. Debenture, 1890, 103-106; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 103-106; Ditto, ditto, to bearer, 104-107; German Union Telegraph and Trust, 10½-10¾; Globe Telegraph and Trust, Limited, 6½-6¾; Globe, 6 per cent. Preference, 12½-12¾; Great Northern, 12½-12¾; 5 per cent. Debentures, 103-106; India Rubber Company, 24-25; Ditto, 6 per cent. Debenture, 104-108; Indo-European, Limited, 28-29; London Platino-Brazilian, Limited, 5½-6; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9¼-9½; Oriental Telephone, ¼-½; Reuter's Limited, 11½-12½; Submarine, 280-290; Submarine Scrip, 2½-3; Submarine Cables Trust, 99-103; United Telephone, ——; West Coast of America, Limited, 4½-5½; West India and Panama, Limited, 1¼-1½; Ditto, 6 per cent. First Preference, 7¼-7½; Ditto, ditto, Second Preference, 6¼-6½; Western and Brazilian, Limited, 7¼-7½; Ditto, 6 per cent. Debentures "A," 110-115; Ditto, ditto, ditto, "B," 101-105; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 125-130; Ditto, 6 per cent. Sterling Bonds, 104-107; Telegraph Construction and Maintenance, Limited, 25½-26½; Ditto, 6 per cent. Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 1½-1¾.